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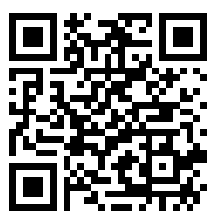

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THE

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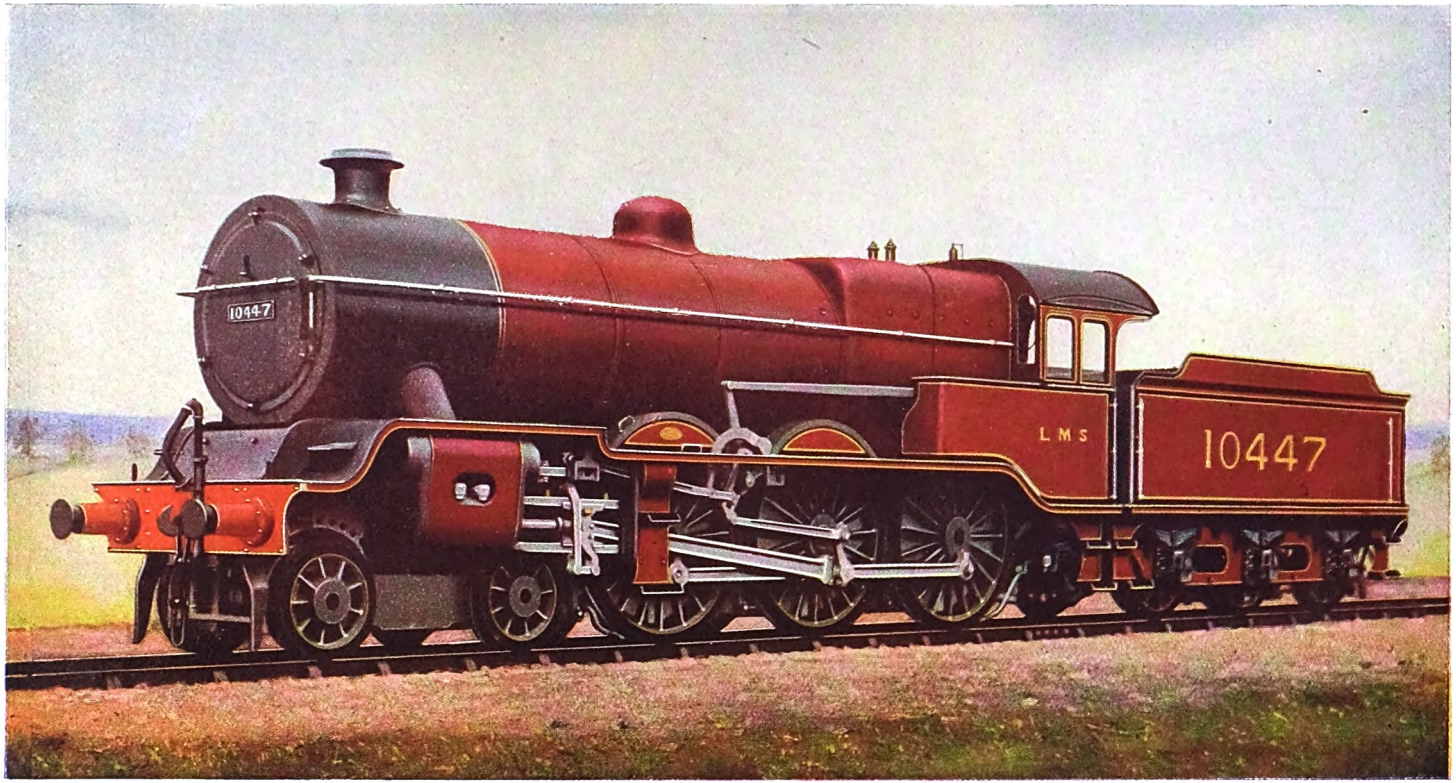

THE RAILWAY MAGAZINE.

FOUR-CYLINDER 4-6-0 LOCOMOTIVE, LONDON MIDLAND AND SCOTTISH RAILWAY

(WESTERN DIVISION).

Painted, numbered and lettered in new style.

DESIGNED BY MR. G. HUGHES, C.B.E., CHIEF MECHANICAL AND ELECTRICAL ENGINEER.

Cylinders (4), 16½ in. × 26 in. Coupled Wheels, 6 ft 3 in. diam. Bogie wheels, 3 ft. 0⅛ in. diam. Steam pressure, 180 lbs. per sq. in.
Heating Surface—Tubes, 1,717 sq. ft.; Firebox, 176 sq. ft.; Superheater, 430 sq. ft.; Total, 2,323 sq. ft. Grate area, 27 sq. ft.
Weight in working order—Engine, 79 tons 1 cwt.; Engine and tender, 119 tons 1 cwt.

Fitted with Horwich Superheater and Wakefield Mechanical Lubricator.

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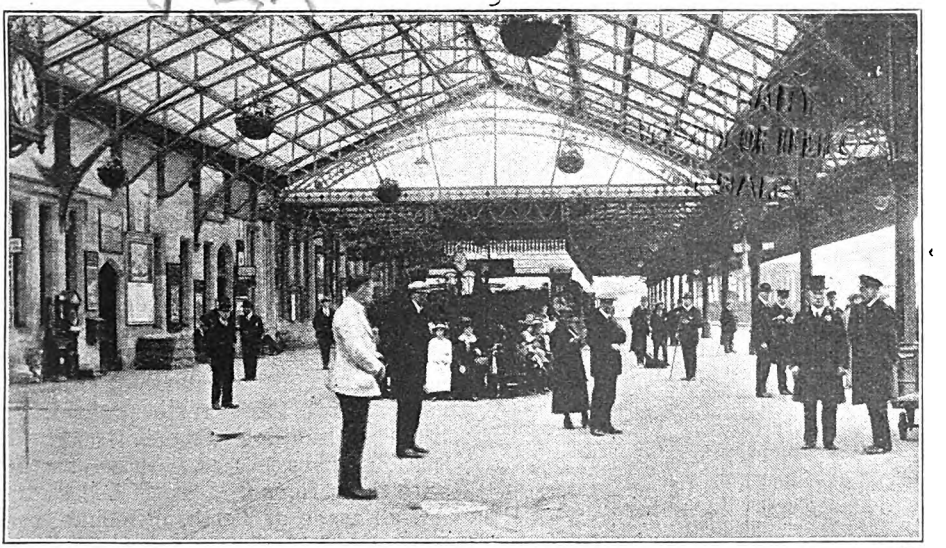

CIRCULATING AREA, DOWN SIDE.

Notable Railway Stations and their Traffic.

PERTH (GENERAL), L.M. & S. AND L. & N.E. RAILWAYS.

By J. F. GAIRNS.

THIS station received attention in our earlier "Notable Railway Station" series, an article thereon, by Mr. James Duncan Robertson, having been published in the May, 1905, number of the RAILWAY MAGAZINE. Since then, however, many changes have occurred, though few of a structural character, while modern traffic developments have given this well-known station an even greater importance and interest than was the case when our former contributor described the station and its traffic.

Perth obtained railway facilities in the 'forties of last century, and by the 'sixties had become a traffic interchange station on a relatively large scale. The fact that the interests of several railways were involved caused the setting up, in 1863, of the Perth General Station Joint Committee, and although the Caledonian amalgamations of 1865 and 1866 reduced the number of companies concerned, there still remained the necessity for co-ordinating and correlating the interests of the Caledonian, North British and Highland Railways, a purpose which was well served by the Committee until the end of 1922. Now that both the Highland and Caledonian Railways are included in the London Midland and Scottish Railway, the Committee necessarily includes a predominant L.M. and S. interest, but the London and North Eastern Railway, as successor to the North British Railway Company, also has its representatives, and as these are appointed in proportion to the traffic and other interests of the companies concerned, the Committee, to which all the staff of the station (except those who belong to one company only, as in the case of the respective booking offices) is directly responsible, provides an effective method of equating all factors.

Although for traffic purposes Perth is a great connecting centre, it is somewhat remarkable that, in the ordinary sense,

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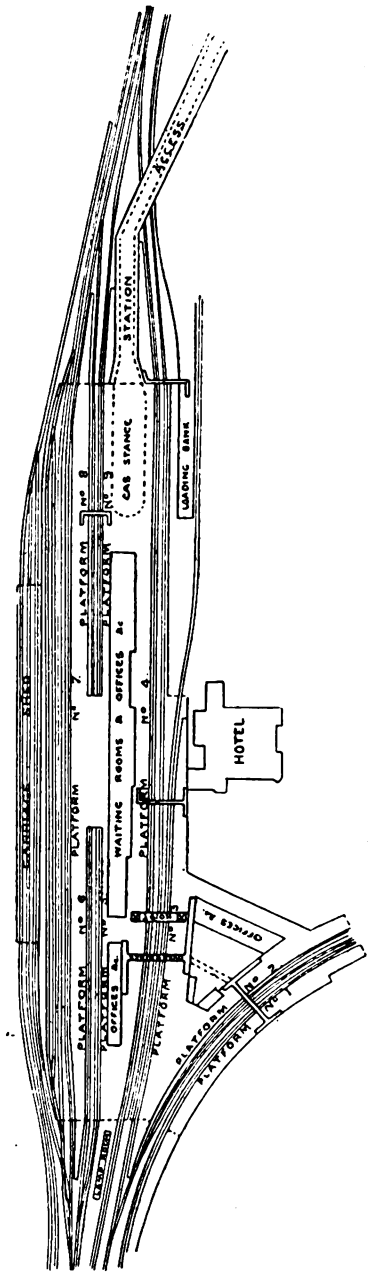

PLAN OF PERTH (GENERAL) STATION.

it is not a junction, except for the Dundee branch. There are, it is true, junctions both north and south, within distances of about two miles each way, and before another station is reached. Thus, the London Midland and Scottish and London and North Eastern routes from the south unite at Hilton Junction, the L.N.E.R. exercising running powers into Perth itself, while to the north Crieff and Methven trains diverge from the Aberdeen main line (L.M. and S.R.) at Almond Valley Junction. But for traffic purposes connections between trains on all these routes, together with those further afield, as at Stanley Junction, where the Highland section diverges, and those associated with the various L.M.S. and L.N.E. routes, are all made at Perth, including in some instances long-distance trains which for considerable mileage travel over the same metals.

Perth is, in fact, the great traffic point in the railway system of Central Scotland, and is the scene of interchange of both vehicles and passengers on a scale for which no other Scottish station, if not in the whole of Great Britain, affords a parallel. There are instances several times daily of groups of trains exchanging vehicles between each to form new trains, while even under normal conditions other hours witness interchange of vehicles on an interesting if less complex scale. For instance, while the principal Anglo-Scottish train services involve interchanges between L.M.S. trains from Edinburgh and Glasgow as well as from England, together with London and North Eastern trains in the case of the Highland trains or sections, at other times there may be two or more L.M.S. and possibly two L. and N.E. trains to be dealt with in the re-formation of north-bound trains for Aberdeen and Inverness respectively, with Dundee portions and engine changes in further complication.

These and other aspects, which are additional to the fairly numerous stopping and branch trains in advance of or following the expresses and through trains, will be further dealt with later, but it is first necessary to describe the station itself. The main station consists of one huge island platform, with two bays let into each end, and with most of the station offices, waiting rooms, refreshment and

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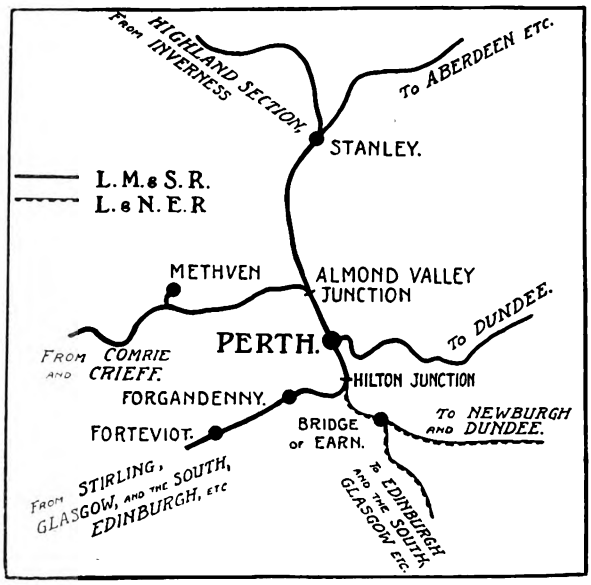
dining rooms, cloak rooms, luggage and parcels offices, booking offices, &c., arranged in a long series of buildings erected upon it. At the north end is a slope and bridge giving access for cabs, mail vans, &c., from Glasgow Road, one of Perth's main thoroughfares, crossing the railway just beyond the station, and along which pass the Corporation electric tramcars. At the south end is a stairway connecting with St. Leonard's Road bridge.

On the down side this island platform is no less than 1,415 ft. in length, but on the up side it is even longer, 1,672 ft. On each side crossovers are provided about midway, so that by using the outside or middle line immediately adjacent trains can reach or leave the north or south portion of each platform without interfering with one standing at the corresponding south or north portion. On the down side there is a second outside line, partly under cover, though since our earlier article was written part of the roofing has been removed and replaced by verandah roofs covering the platforms only. These outside lines and the middle lines beyond the main up platform are largely utilised for re-marshalling purposes, changing engines, &c. The main platform faces are now numbered as separate platforms, the down being known as No. 7 (south) and No. 7 (north) and the up as No. 4 (south) and No. 10 (north), to facilitate reference and direction.

At the north end the dock line (No. 8) nearest the down main is generally used by Highland Section trains, and is 655 ft. long. Alongside is the "Crieff Dock" (No. 9), 665 ft., whence trains for Crieff and Methven usually depart. At the south end both docks are principally used by London and North Eastern trains for the south and east, that on the up side (No. 5) being 713 ft. in length, and that on the down side (No. 6) 550 ft. in length.

Besides the big island platform, however, there is another platform in the main portion of the station, opposite Nos. 4 and 10 and adjacent to the well-known Station Hotel (managed by the Joint Committee),



SKETCH MAP, SHOWING ROUTES CONVERGING ON PERTH.

which is located in the angle between the main and the Dundee station. This platform (No. 3) is generally referred to as the Hotel platform. It is 679 ft. in length. At the north end it leads to a space containing horse and carriage loading docks and carriage cleaning sheds, and is therefore not fitted for through train movements, though it is extensively used for re-marshalling and combining purposes. The Dundee platforms (Nos. 1 and 2) curve away from the south end of the main platform, so that their traffic can be operated, except for through traffic purposes, more or less independently of the main station. There is a middle line between these platforms.

It is necessary to mention also the goods lines which pass outside the station on the down side, also the carriage sheds between the goods lines and the station, and the London and North Eastern Goods Depot beyond the goods lines. London Midland and Scottish goods yards are located alongside the main lines both north and south of the station. Beyond the road bridge which crosses the station at the north end is a ticket platform on the up line, necessary in view of the fact that Perth is an open station, and it is not always practicable to collect tickets at the previous stopping station or on the trains. There

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is a corresponding platform on the down line approaching Perth from the south.

Traffic is worked by four signal boxes under the control of the Perth station-master. The largest is St. Leonards, just south of St. Leonards Road bridge. This has 122 levers, and controls all working at the south end of the station. At the north end is Glasgow Road box, 54 levers. Working within the station itself is, however, controlled by two boxes, one for each section, known, respectively, as Up Centre (41 levers) and Down Centre (20 levers).

Above the buildings on the main island platform are offices, chiefly accommodating the District Traffic Superintendent and the District Engineer and their respective staffs, together with offices for the London and North Eastern agent, &c., and East and West Coast traffic representatives. Connecting the Hotel platform and the Dundee station with the main island platform is a wide footbridge about midway, while narrower footbridges span the Highland and Crieff dock lines and connect the two Dundee platforms. Several booking and other offices are provided on the main island platform and elsewhere so that passengers requiring to re-book can do so without having to go far for the purpose. The refreshment and dining rooms are open from very early hours until late at night, so that passengers can have their needs supplied in this respect practically at any time. Large projecting clock faces about midway along each main platform constitute distinctive features, though the outstanding characteristic of the station is the splendid view on the up side at times when, as is occasionally but not generally the case, it is not obstructed by trains and engines. Book, fruit and confectionery and tobacco stalls are located here and there, while clock face finger post indicators direct passengers to the various trains.

Owing to the complex character of the traffic dealt with at Perth, it is not usual to advertise by poster the platforms at which individual trains will be dealt with. This is due mainly to the frequency with which important trains are duplicated or divided, and their liability at heavy traffic periods to arrive out of order. Full advantage is, however, taken of all the possibilities available, all the main line platforms being signalled both for up and down working. A special feature is the very large number of Pullman cars, mostly running as restaurant cars and therefore not involving the payment of supplements, together with one or two restaurant car services, terminating at or

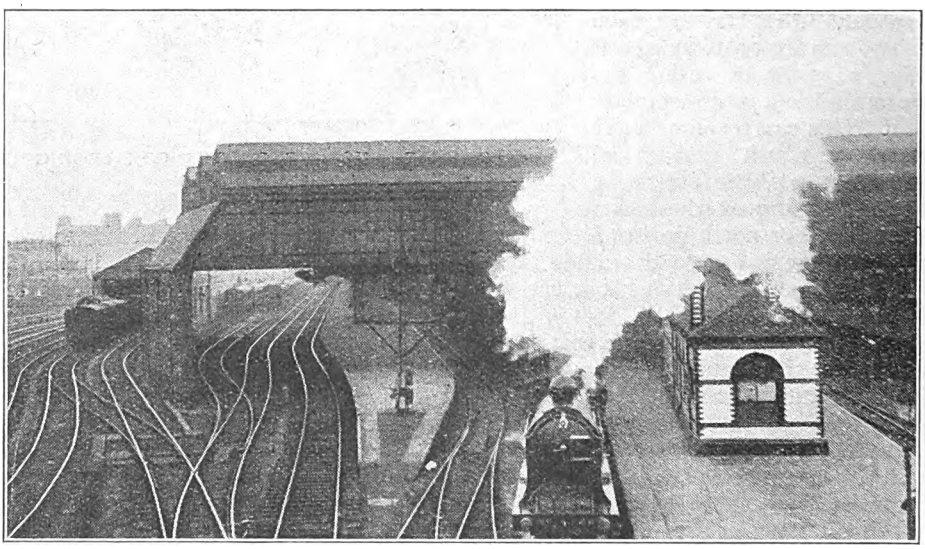

Photo.] [*J. F. Gairns.*

DOWN SIDE OF STATION, GOODS AND CARRIAGE SHED LINES TO LEFT.

London and North Eastern train for Edinburgh leaving.

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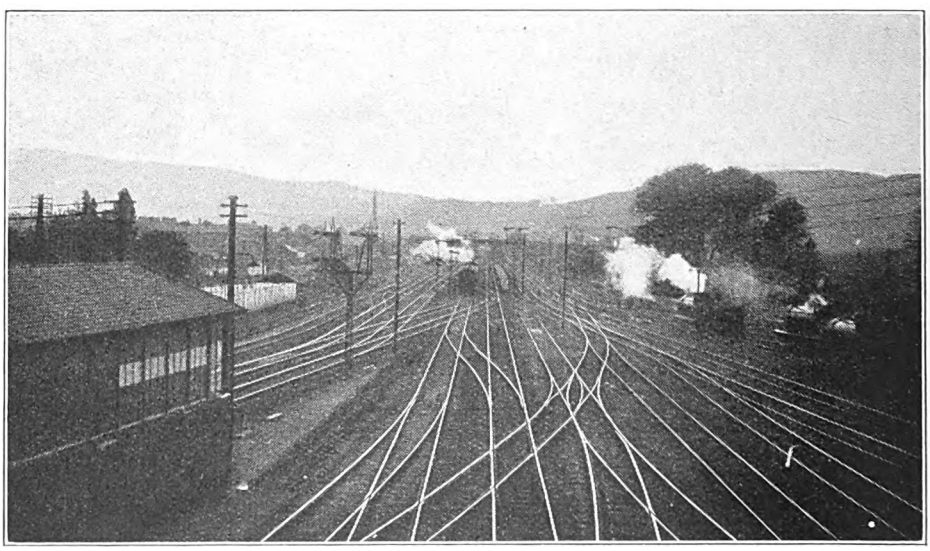
donian or North British locomotives for Highland.

These trains constituted the advance guard, and unless they had to be combined did not involve re-marshalling, except for the attachment or removal of a van or so. The standard trains were due ten minutes later in each case, but the West Coast train also had an Aberdeen sleeping car section, so that, unless the East Coast and the West Coast Highland trains and the West Coast Aberdeen train were run as complete sections, a degree of re-marshalling was entailed. The Aberdeen portion was due away at 5 a.m., and the Inverness ten minutes later, though the latter actually reached the "Capital of the Highlands" in advance of the 4.50 a.m. relief, the latter being booked north of Aviemore via Forres and Nairn.

At 5.33 a.m. another West Coast sleeping car express arrived—on Mondays, when the trains above reviewed did not run, and during the winter and spring months of the year, this also dealt with the West Coast-Highland vehicles—with through carriages and sleeping car for Aberdeen (depart 5.40 a.m.) and Dundee (depart 6.17 a.m.), so that extensive re-marshalling was entailed. Then at 6.7 a.m. arrived the "Limited Mail," the well-known "Postal Train" from Euston at 8.30 p.m. the previous night, with the Glasgow portion attached at Stirling. This train took passengers as far as accommodation would permit (hence the term "Limited" and the restrictions as to the conveyance of luggage, &c.) for its flying run to Aberdeen. During last summer the mail portion also brought the West Coast Penzance-Aberdeen through carriage from Crewe, though otherwise it was, and is, a non-passenger train south of Stirling.

Arrival of this train produces a scene of "ordered hustle" as the mails are transferred to the Highland sorting carriages which go forward at 6.25 a.m. The Highland mail train in winter takes also the London sleeping cars and through carriages, both East Coast and West Coast, but even without them is a fairly heavy train, especially since it has had added a Pullman Breakfast Car for Aviemore, while the re-marshalling involved includes vestibuling up with the London through carriages.



APPROACH LINES FROM THE SOUTH.

As in the case of most groups of trains at Perth, each is associated with stopping and branch trains in advance and following, both London Midland and Scottish and London and North Eastern. The next group completes, however, the down sleeping car services. This involves: (1) the East Coast train due at 8.53 a.m., with London-Perth through carriages and

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sleeping car (these terminate at Perth); (2) the Glasgow-Aberdeen Pullman Breakfast Car express due at 9.5 a.m.; (3) the West Coast London Dundee sleeping car express (with Pullman Breakfast Car from Carstairs to Perth) due at 9.12 a.m.; and (4) the 9.20 a.m. to Aberdeen and 9.12 and 9.30 a.m. to Dundee.

Except for a semi-fast train from the south at 9.40 a.m. and a Glasgow express at 10.52 a.m., matters are easier until the midday group has to be dealt with. At very busy times and at "month-ends" during the summer there were reliefs, such as the Highland express from Edinburgh (Waverley) at 9.56 a.m. (specified dates only), which called at Perth to change engines, but the standard trains were those from Edinburgh at 11.21 and Glasgow at 11.33 and 11.45 a.m. by the London Midland and Scottish route, and the London and North Eastern trains from Edinburgh at 11.39 and Glasgow at 11.55 a.m. The 10 a.m. from Glasgow, with its London Midland and Scottish connection from Edinburgh (Princes Street), after detachment of the Dundee section, left at 11.41 a.m. for Aberdeen.

The London and North Eastern Railway Edinburgh train was for the Highland line only and was combined (if not operated separately) with the 10.10 a.m. from Glasgow (Buchanan Street), on which a Highland engine worked through from Glasgow to Inverness, to form the 11.55 a.m. and 12.5 p.m. trains for Inverness. The former was booked non-stop to Newtonmore and travelled via Forres, so that the 12.5 p.m. reached Inverness only two minutes later. Both trains included Pullman luncheon cars, and connected at Inverness with the "Farthest North" train for Wick and Thurso. The Glasgow train also included a through carriage from Glasgow to Aberfeldy. Seeing that there were through portions for both Highland routes from both the London Midland and Scottish Glasgow, and London and North Eastern Edinburgh trains, with the Aberfeldy through coach on the former, to be rearranged to form two separate Highland trains, attention being also necessary to connecting up the Pullman cars, the re-marshalling operations were probably as complex as any dealt with at Perth.

At 1.35 p.m. a new 12 noon Glasgow-Aberdeen Pullman restaurant car express was dealt with, followed two hours or so later by another elaborate series of trains, due at 3.4 p.m. from Edinburgh (Princes Street), at 3.10 p.m. from Edinburgh (Waverley), at 3.14 p.m. from Glasgow (Buchanan Street), with Pullman restaurant car for Aberdeen, and at 3.22 p.m. from Glasgow. These connected with or formed the 3.22 p.m. for Aberdeen, the 3.28 p.m. for Dundee and the 3.40 p.m. for Inverness. The last mentioned had through carriages from both Glasgow (London Midland and Scottish route) and Edinburgh (London and North Eastern route) to Inverness, and by the former to Aberfeldy also, while it further included a London and North Eastern restaurant car working through from Edinburgh as far as Blair Atholl.

Apart from secondary, stopping and other services, the Glasgow-Aberdeen train at Perth 6.39-6.50 p.m., the Glasgow train due at 7.45 p.m., the East Coast service from King's Cross at 10 a.m., due Perth 7.55 p.m., and the London and South connection off the 10 a.m. ex Euston at 8 p.m., forming the 8.8 p.m. for Aberdeen, with Dundee trains in connection, completed the day's work on the down side. Except for alterations affecting the early morning services and combinations of certain services, more particularly of a tourist and holiday character, most of these trains have their counterparts during the winter months. In fact, many of them, notably the Glasgow, Edinburgh, Perth, Dundee and Aberdeen expresses are primarily all-the-year-round business services.

On the up side there were corresponding series of trains. The principal groups were those about 9 a.m., 12 noon, 3 p.m., 5.30 p.m., and the up night series from 7.40 to 10.15 p.m., together with a few other important trains more or less isolated, such as the 5.5-5.50 and 7.5 a.m. trains from Perth to Glasgow, the latter taking the Inverness-Glasgow sleeping car. From Aberdeen principal expresses, in nearly every case with a Pullman restaurant car, arrived at 8.57 a.m., and 12.11, 12.40, 2.38, 2.59, 5.17, 7.40 and 9.55 p.m. The chief Highland arrivals were at 5.5 and 11.56 a.m., and 2.20, 2.40, 7.5, 7.15, 8.20 and 8.40 p.m.

The respective groups which, together

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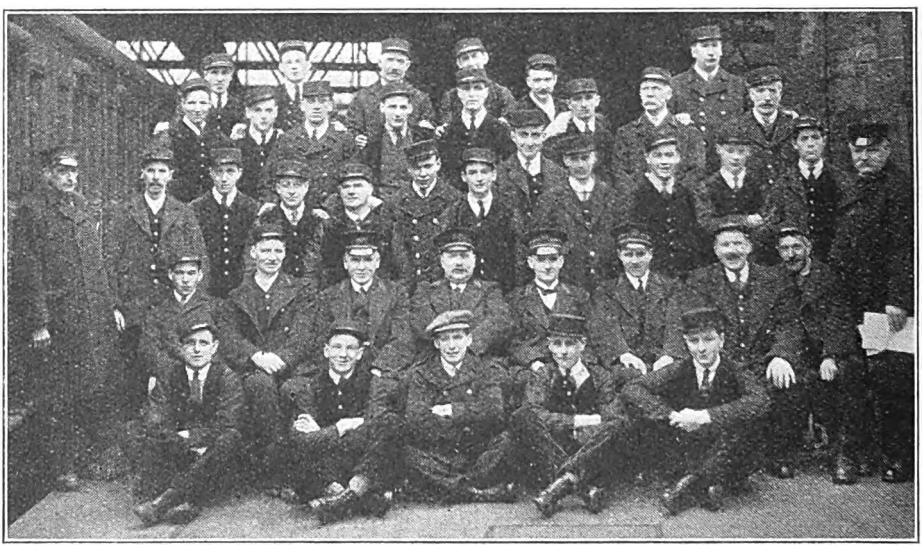
with the Dundee branch, contributed in most cases through carriages and included Pullman car facilities, sleeping cars, &c., may be stated as follows :—

7. 5 a.m. L.M.S. Perth to Glasgow. Sleeping car Inverness to Glasgow.
8.40 a.m. L.N.E. Through carriage, Perth to London (King's Cross).
8.48 a.m. L.M.S. Dundee-Glasgow Pullman car express.
9. 7 a.m. L.M.S. Aberdeen-Glasgow (and Edinburgh) Pullman car express, and Dundee-London (Euston) through carriages.
10.55 a.m. L.M.S. Dundee-Glasgow express, with through carriage from Aberfeldy to Glasgow.
5.33 p.m. L.M.S. Aberdeen-Dundee-Glasgow express, with Pullman car attached at Perth.
7.40 p.m. L.M.S. Highland-Glasgow express, with Pullman car from Aviemore and through carriages from Inverness and Aberfeldy to Glasgow.
7.50 p.m. L.M.S. Aberdeen-Glasgow Pullman car express.
7.53 p.m. L.N.E. Inverness-Edinburgh express.
8.35 p.m. L.M.S. Special Highland sleeping car express to London (Euston). Within specified dates only.
8.45 p.m. L.N.E. Special Highland sleeping car express to London (King's Cross). Within specified dates only.
9.10 p.m. L.M.S. Ordinary Highland sleeping car express for London (Euston).



SOME OF THE STAFF AT PERTH (GENERAL) STATION.

12. 8 p.m. L.M.S. Dundee-Glasgow express, with Highland and Dundee connections.
12.15 p.m. L.N.E. Through carriage, Perth to London (King's Cross).
12.22 p.m. L.M.S. Aberdeen-London (Euston) express, with Pullman car from Perth to Symington.
12.50 p.m. L.M.S. Aberdeen-Glasgow Pullman car express.
2.40 p.m. L.M.S. Aberdeen-Glasgow express, non-stop, Perth to Glasgow.
3. 5 p.m. L.M.S. Highland and Dundee-Glasgow express.
3.16 p.m. L.M.S. Aberdeen-Glasgow express.
3.25 p.m. L.M.S. Pullman car express to the South (conveying also Aberdeen-Penzance through carriages).
3.35 p.m. L.N.E. Highland express for Edinburgh.
5.25 p.m. L.M.S. "Limited Mail" (no passenger accommodation), portion of 3.25 p.m. ex Aberdeen.
9.20 p.m. L.N.E. Ordinary Highland sleeping car express for London (King's Cross).
10. 5 p.m. Aberdeen and Dundee sleeping car express for London, with through carriage from Aberdeen to Liverpool, and on Thursdays (in connection with transatlantic steamers) to Southampton.
10.15 p.m. Glasgow express.

Bearing in mind that these involved extensive re-marshalling operations, as in the case of the down traffic, that Dundee through sections were largely included, and that certain services, especially those from the Highland section, needed frequent division in the height of the season, it will be seen that as a passenger traffic and re-marshalling centre there are few stations which can be compared with

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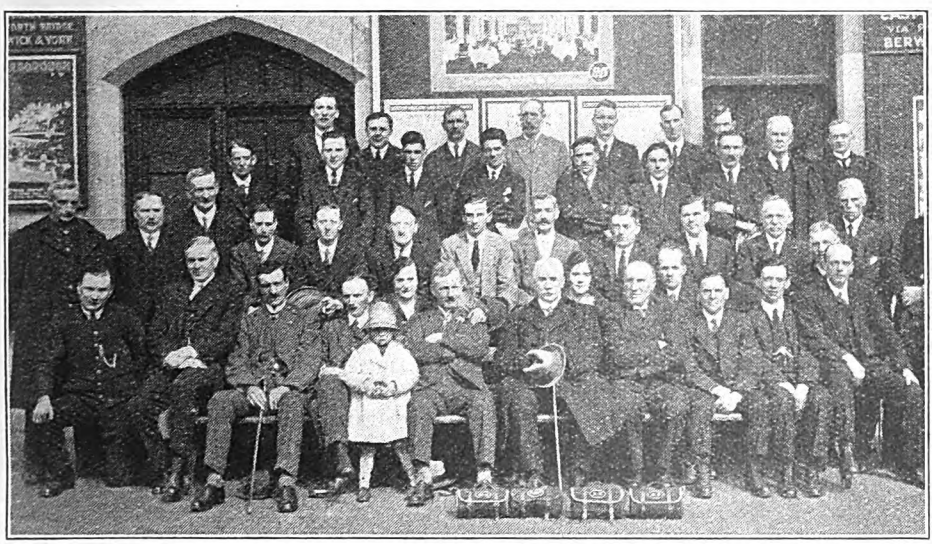
Perth. Moreover, a great deal of this work applies all the year round, though accentuated during the holiday seasons.

Although incidental reference only has been made to the branch and associated services, it may be mentioned that many of these routes carry considerable traffic on their own account. Thus, the Dundee branch has about 20 trains daily in each direction, a number express and with through carriages and sections of the Glasgow trains. Besides the London Midland and Scottish line stopping trains north and south of Perth, some of which work between Perth and terminal stations other than Aberdeen, such as summer, through carriages between Dundee and Aberfeldy and Blair Atholl, and in some instances on other routes involving re-marshalling at Perth. On its own account Perth is a favourite residential and tourist centre, while it has industrial activities which cause it to produce traffic on a considerable scale in addition to that passing through. It is also a great centre for horse sales and horse-box traffic produced thereby, especially on the second Monday in each month and on Fridays, and in agricultural connections it is an important market town.

Consequently, what with the heavy and complicated shunting operations, which



MEMBERS OF THE PERTH (GENERAL) STATION BOWLING CLUB.

Alyth, Montrose, Arbroath, &c., the Bankfoot branch trains usually run to and from Perth, while a fairly frequent service is run between Perth and Crieff via the Almond Valley branch. The London and North Eastern Railway, besides running a considerable number of trains on the Edinburgh-Perth line, including Glasgow and other services coming upon it, also operates trains between Perth and Ladybank and Perth and Dundee, St. Andrews, &c., via Newburgh. On the Highland line, besides the through trains, both express and stopping, there are locals between Perth and Dunkeld, Pitlochry and Blair Atholl.

In further complication there were, last

require three shunting engines continuously in service, apart from the assistance rendered by train engines, the heavy parcels and luggage and mail transfers involved, the number of Pullman and sleeping cars and through carriages to be attached or detached, and in many cases stabled, cleaned and equipped, and the frequency with which trains are divided and duplicated at busy periods, Perth is probably one of the most difficult stations on the British railway system. The fact that Gleneagles, with its famous golf courses and the new hotel just completed, is conveniently accessible, in conjunction with the high favour in which the Perth Station Hotel is regarded, further explain

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MR. J. HARDMAN.

Station Superintendent, Perth (General) Station.

why Perth, with its historic and other associations, has a large tourist and holiday as well as traffic, agricultural, industrial and trading importance.

The L.M.S. (Caledonian) and L.N.E. (North British) engine sheds are some distance south of the station, and the L.M.S. (Highland) sheds to the north. The goods lines pass outside the passenger station. Associated with them and north and south of the station are goods stations belonging to the London and North Eastern Railway and to each section concerned of the London Midland and Scottish Railway.

Mr. J. Hardman, Station Superintendent, was appointed Assistant Station Superintendent in February, 1903. He entered joint London and North Western and Lancashire and Yorkshire service at Preston Joint Station in 1882 as a porter, eventually becoming platform inspector. His lengthy experience of joint station working was no doubt a reason why he was selected in 1903 to be Assistant Station Superintendent at Perth, the position he occupied when our former article was published. In 1908 he followed Mr. Willis Holt, now Traffic Superintendent, Metropolitan Railway, as Station Superintendent.

He is assisted by 2 supervisory inspectors, 4 platform inspectors, and about 90 other grades of joint station traffic staff. There are also clerks, &c., associated with the booking offices, &c., of the respective companies or on other duties of a non-joint character, under the respective chiefs. Mr. Williamson is Chief Booking Clerk, London Midland and Scottish Railway, while the London and North Eastern Goods Agent, Mr. Proven, also supervises the London and North Eastern booking and office staffs. Mr. Auld is the London Midland and Scottish agent. Mr. Nisbet is in charge of the L.M.S. (Highland), Mr. Dalziel of the L.M.S. (Caledonian), and Mr. Fletcher of the London and North Eastern engine sheds. Perth Station Hotel (Joint) is under the management of Mr. Foster. Carriage cleaning is now in the hands of the London Midland and Scottish Railway Carriage and Wagon Department, under Mr. Hain, except for that relating to the London and North Eastern Railway, which is dealt with by a separate staff.

The divisional and district offices, though located at the general station, are not, of course, directly concerned with station working.

In conclusion, acknowledgment is made of the courteous co-operation and assistance rendered in the collection of information and particulars regarding Perth Station, by Mr. C. R. Byrom, General Superintendent, Passenger Commercial; Mr. J. Ballantyne, General Superintendent, Northern Division; Mr. J. Smyth, District Superintendent; Mr. R. W. Gairns, District Engineer, in the case of the London Midland & Scottish Railway, and of Mr. W. M. Teasdale, Advertising Manager, and other officers of the London & North Eastern Railway, also of Mr. Hardman and his staff.

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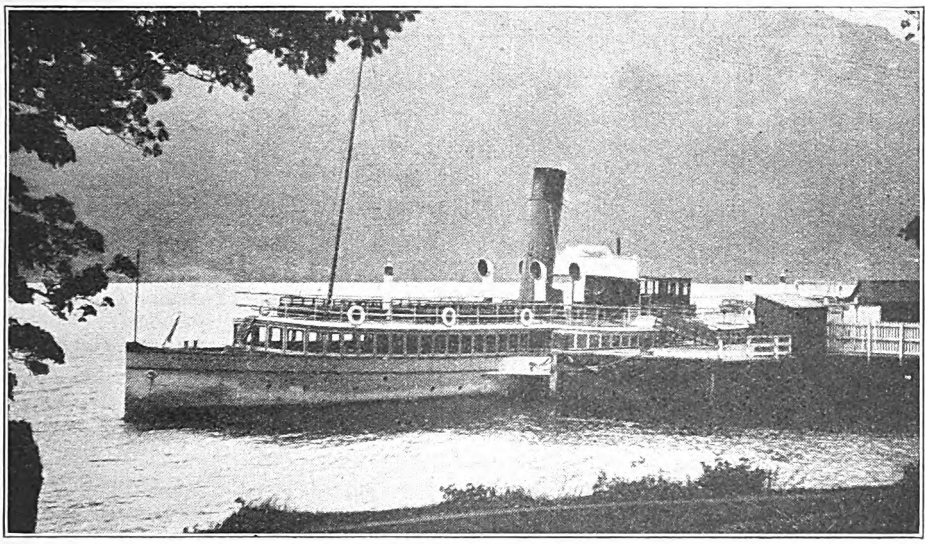

STEAMER "PRINCE GEORGE" AT ARDLUI PIER.

Loch Lomond and the Dumbarton and Balloch Joint Railway.

By J. FRANCIS.

IN addition to the great mountain scenic lines in Scotland, notably the West Highland, Highland and Callander and Oban routes, each of which provides a hundred miles or so almost, if not quite, continuously among the finest mountain and loch scenery in the British Isles, there are many shorter lines which give access to places of equal interest, and which are used by tourists in very large numbers at holiday periods and during the summer months. Of these may be mentioned the western lines of the late Great North of Scotland Railway, the Skye line of the Highland, the North British Aberfoyle line (for the Trossachs) and the North British and Caledonian Balloch line, not to mention many other sections of one or other of the two great companies which now divide the Scottish railway system between them.

The present article is concerned mainly with the lines which serve Loch Lomond, and the railway-operated steamer services thereon. In many respects it may be considered as supplementary to and bringing up to date that contributed by Mr. Tom Moffat to the July, 1913, number of the RAILWAY MAGAZINE. As then explained, the scenic attractions of Loch Lomond, situated so close to the busy and crowded Glasgow district, though in itself having tourist attributes which one hardly expects to find within many miles of a great industrial area, were early realised. Railway facilities to the shores of the Loch date back, indeed, to 1850, when on July 15 of that year the Caledonian and Dumbartonshire Junction Railway Company completed its line from Bowling, on the Firth of Clyde, near the point where the Forth and Clyde Canal joins its broad waters, to Balloch, a distance of 8½ miles. Steamers had, however, plied upon the waters of the Loch for many years previously, back to 1817, in fact. The New Loch Lomond Steamboat Company, formed in 1845, associated rival concerns then operating vessels, its interests being taken over in 1889 by the

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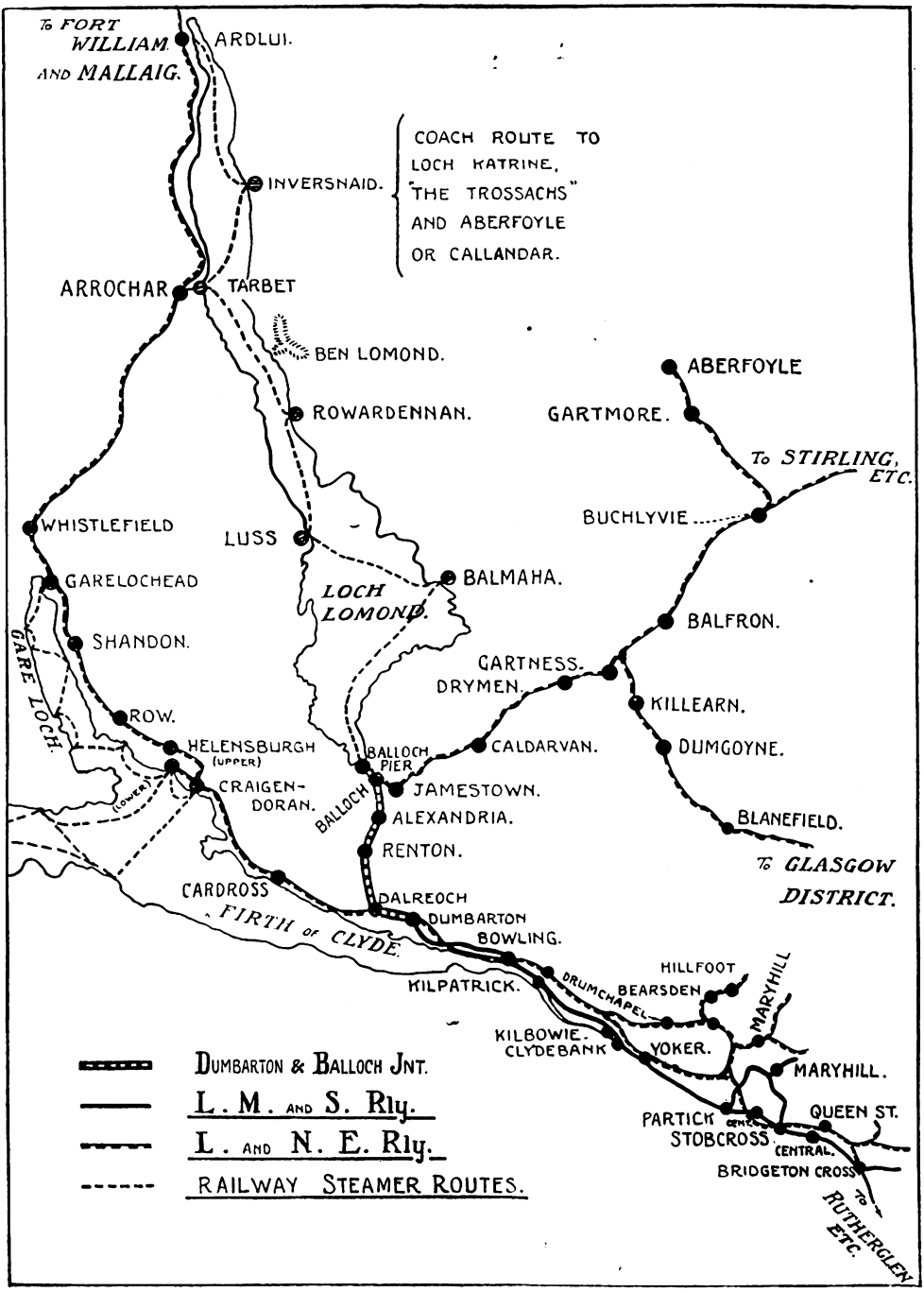

MAP, SHOWING DUMBARTON & BALLOCH JOINT RAILWAY, L.M.S. AND L. & N.E. LINES IN CONNECTION, AND RAILWAY STEAMER ROUTES.

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North British Steam Packet Company. This company, in which the North British Railway was interested, was already operating the Clyde services between Craigendoran and various resorts on the Firth.

The original Caledonian and Dumbartonshire Junction Railway was taken over by the Edinburgh and Glasgow Railway in 1862, becoming North British, together with the Glasgow, Dumbarton and Helensburgh Railway (opened May, 1858), in 1865. Except for more recent developments affecting the North British system in the Glasgow district, it was this company which provided for many years the principal means of rail access to Loch Lomond. In 1891, however, the Lanarkshire and Dumbartonshire Railway was projected, not only to provide a route in connection with the Caledonian Railway from Glasgow to Dumbarton, but also with a view to an alternative line to the shore of Loch Lomond at Aber Bay. Naturally, this was not viewed favourably by the North British Company, and this route from Glasgow to Dumbarton was not, in fact, completed until October 1, 1896. Meanwhile, however, as a result of protracted negotiations, the Loch Lomond extension had been abandoned, and under the Joint Line Act of 1892 the Loch Lomond steamers and the North British line between Dumbarton and Balloch Pier were vested in a Joint Committee representing the North British, Caledonian and Lanarkshire and Dumbartonshire Railway Companies. As the last-mentioned was taken over by the Caledonian in 1909, only the two great companies remained, so that the Joint Committee now comprises London and North Eastern and London Midland and Scottish representatives.

As a result, while the respective companies have their independent routes between Glasgow and the outskirts of Dumbarton, and the London and North Eastern also utilises the Joint Line to reach Craigendoran Pier and Helensburgh, and to obtain access to the West Highland line, the Balloch services are operated as arranged between the two companies to suit the Balloch line and Loch Lomond traffic of both. Further, as the steamers are also jointly owned, all facilities, both ordinary and excursion (unless confined to specific trains) include inter-availability of tickets from and to Glasgow stations by either route. Local passenger traffic on the branch, together with goods traffic due to the fact that it serves an area which is industrially important, also comes under the Joint Committee, except for through traffic worked by whichever company is concerned. Besides the Joint Line there is, however, the London and North Eastern Forth and Clyde line from Stirling and Alloa, which comes into Balloch station from the east.

As will be seen from the map reproduced, both the London and North Eastern and London Midland and Scottish Railways have alternative routes between Glasgow and Dumbarton. Moreover, both work most of the trains concerned via their respective "underground" lines, Queen Street Low Level and Central Low Level, and as neither is an actual terminal, though some trains may run empty thereto or therefrom, a majority of the trains combine journeys on either side, except that many of the London and North Eastern trains make Bridgeton Cross their terminus. That railway can also send trains in the Dumbarton direction from Queen Street High Level via Cowlairs, but this applies principally to trains to and from the West Highland line.

Practically all the London and North Eastern Balloch (also the Craigendoran and Helensburgh) trains are therefore dealt with at Queen Street Low Level station, where the fact that there are island platforms in each direction enables them to stand for a few minutes to permit of convenient entraining and detraining of passengers and luggage handling, notwithstanding that the station is not actually a terminal. Many trains call at Charing Cross and Partick, or at the latter, even if booked "fast" beyond, so that, in combination with calls at Bridgeton Cross and High Street, or at stations on suburban routes leading to Queen Street Low Level, it is often possible to join a train for Balloch, Craigendoran or Helensburgh at a station convenient to the passenger instead of requiring to travel first to the terminus. Beyond Partick trains can travel either via Yoker and Clydebank or via Great Western Road and Singer, thus permitting of intermediate calls as found desirable to suit through traffic, as well as to take a part

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in supplying the transport needs of the busy areas traversed.

In the case of the London Midland and Scottish Railway most of the trains reach the Central Low Level station (which also has island platforms in each direction) from various suburban lines, and as the route east of the Central station traverses to some extent the same districts as the London and North Eastern lines, most of the remarks made in regard to the one railway apply substantially also to the other. The London Midland and Scottish route has, in fact, its alternative via Kelvinbridge and Kirklee, though this is but rarely taken by trains for Dumbarton or beyond. The fact that the lines of the two companies are so closely associated and in many places interwoven explains why the setting up of a Joint Committee for Balloch line traffic provided the best means of preventing undue competition and of safeguarding the interests of both parties. Consequently, although each has its own routes and operates its own services to Dumbarton, the actual junction being a short distance east of Dumbarton Joint station, the Balloch services are operated as arranged between them, and nearly all tickets, excursion as well as ordinary, are interavailable.

Although the respective routes have been more or less in sight of one another (crossing, in fact, twice) practically all the way from Yoker, both following the Clyde very closely and having access to various shipyards and industrial establishments, connection is not made until the junction, 30 chains east of Dumbarton Joint station, at a point connecting also with the Dumbarton goods yard, &c. Dumbarton Joint station has two island platforms, for which reason, when Balloch line locals are run, or in the case of associated fast and stopping trains, connections are usually made there and not at Dalreoch, where the Balloch branch actually diverges.

Dalreoch station is on a fairly sharp curve, the branch continuing almost due north, while the Craigendoran and Helensburgh line curves away westward, through a short tunnel. The Balloch line has two intermediate stations, Renton and Alexandria, but for nearly the whole of its length it passes through a busy industrial area, the district—the Vale of Leven—being famed for its dye works, and there are three branches, one of fair length from Cordale Branch Junction and the other two north and south of Alexandria, all serving mainly various dye works on the banks of the River Leven, which the railway approximately follows.

DALREOCH STATION, SIGNAL CLEAR FOR BALLOCH BRANCH.

At Forth and Clyde Junction the

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TRAIN SERVICES TO AND FROM BALLOCH PIER.

Days running	..	..	..	—	—	—	S.O.	S.E.	S.O.	S.O.	S.O.	T.W.S	S.O.	S.O.	S.O.	S.E.	S.E.	S.O.	S.O.										
Train through from	..	..	..	C	B	R	R	R	SP.	R	R	B	R	SP.	R	R	R	R	B										
Queen Street L.L. dep.	..	..	..	(7.55)	10.35	—	(12.0)	(12.0)	1.55	—	(2.13)	1.48	2.0	3.25	(4.0)	(4.0)	(4.20)	(5.8)	5.43										
Central L.L. dep.	..	..	..	8.15	(10.23)	10.59	12.50	12.50	(1.13)	1.41	2.0	—	—	(2.43)	3.43	3.58	4.31	4.44	—										
Balloch Pier arr.	..	..	..	9.18	11.45	11.52	1.46	2.0	2.39	2.49	3.8	2.58	—	4.17	4.50	4.52	5.32	5.51	6.46										
Days running	..	..	..	M.O.	M.E.	—	T.W.S	S.O.	S.O.	S.E.	S.O.	S.O.	T.W.S	S.O.	S.O.	T.W.	S.O.	T.W.S	S.E.	S.O.	S.O.								
Balloch Pier dep.	..	..	..	8.45	10.35	3.42	4.35	5.0	6.0	6.35	6.35	6.38	7.0	7.44	7.54	8.10	8.35	—	—										
Central L.L. arr.	..	..	..	9.34	11.32	(5.18)	(6.16)	5.56	7.12	7.19	7.34	—	8.10	(9.20)	(9.20)	9.20	(9.56)	—	—										
Queen Street L.L. arr.	..	..	..	(9.47)	(11.46)	4.40	5.41	(6.36)	(7.21)	—	(7.27)	7.27	—	8.42	8.52	9.32	9.24	—	—										
Train through to	..	..	..	R	R	Q	B	A	A	R	R	Q	CB	B	B	R	Q												

B—Bridgeton Cross. SP.—Springburn. C—Central L.L. R—Rutherglen or beyond. TWS—Tuesdays, Wednesdays and Thursdays.
A—Airdrie. CB.—Coatbridge. Q—Queen Street L.L. TW—Tuesdays and Wednesdays.

London and North Eastern Forth and Clyde line makes connection, Balloch station being a short distance beyond. This is the terminus where steamer connections are not concerned, though most trains proceed onwards a short distance to reach terminal and reversing sidings and to serve the goods lines. Boat trains, however, continue on to the Pier station, half a mile beyond the town station. On the Pier are waiting-rooms and other accommodation, and trains stand so that passengers have only to cross the platform to join the steamer alongside. Being located right at the mouth of the River Leven, Balloch is a favourite boating centre. In fact, during the summer months the scene from the road bridge which crosses the river from Balloch station is suggestive of those to be seen at Wroxham and other places on the Norfolk Broads, or on the Thames, the waters as they broaden out to Loch Lomond being dotted with pleasure boats, yachts, houseboats, motor boats and other craft.

For traffic on the Balloch branch generally there were, in the summer of 1923, about ten London and North Eastern trains through from Glasgow and about 24 London Midland and Scottish trains, in view of the fact that the latter had no alternative destination beyond Dumbarton, so that in many cases it was convenient to arrange for London Midland and Scottish trains to provide Balloch connections for London and North Eastern Craigendoran and Helensburgh trains. Each route had, however, its own trains for the principal steamer services, as indicated by the accompanying table (services involving a change shown in brackets).

It will be noticed that there were wide differences between the services on various days of the week, especially on Saturdays, but noticeably also in regard to Tuesdays and Wednesdays, owing to the fact that Tuesday is early closing day in Glasgow and Wednesday in many of the surrounding towns. Attention may also be directed to the remarkable sequence of return trains on Saturday evenings, requiring boat trains from Balloch Pier at 4.35, 5.0, 6.0, 6.35, 6.38, 7.0, 7.54, 8.10 and 8.35 p.m. by one route or the other. Towards the close of the season, from September 15, these services were somewhat modified.

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Quite a number of the trains by both routes were relatively fast, while in other instances fast London and North Eastern Craigendoran trains had London Midland and Scottish connections for Balloch. There were, of course, numerous other trains, through and connecting, by both lines serving Balloch line stations, but not proceeding through to the Pier, as there is a heavy local workmen's, residential and industrial traffic all the year round. On the Forth and Clyde Railway there were five trains each way to and from Balloch, on the route from Stirling. Of these the 10.37 a.m. from Stirling (with through connection from Edinburgh) was continued to Balloch Pier (due 11.58 a.m.), while the 3.35 p.m. from the Pier provided a return service. On Tuesdays, Wednesdays and Saturdays the 4.55 p.m. from Balloch to Balfron started from the Pier at 4.50 p.m.

Having thus dealt with the railway services, the steamer services on Loch Lomond must be considered. These left Balloch Pier at 9.25, 12 noon and 5 p.m., and at 3.15 p.m. on Saturdays, 2 hours 10 minutes being taken for the journey to Ardlui, with calls at six intermediate piers. Return boats left Ardlui at 6.30 (Mondays only), 8.30 (Mondays excepted), 1.25 and 4.15 p.m., and at 6.10 p.m. on Saturdays. In addition, short cruises were made by railway steamers around the islands of Loch Lomond on Tuesdays, Wednesdays and Saturdays, from 2 p.m. at intervals until sunset. For these cheap fares were charged from Balloch Pier, adults 9d., juveniles 6d. Cheap fares were in regular operation, including rail and steamer, from Glasgow stations to the various piers on the Loch.

Special interest attaches to the various Trossachs and other tours operated by the respective companies and including steamer travel on Loch Lomond. Some of these included Edinburgh as well as Glasgow, and were available either way round. One is given below.

In the reverse direction the outwards trains were from Glasgow at 8.6 and 9.50 a.m., and Edinburgh at 6.25, 7.35 and 9.10 a.m., according to route. In every case either London and North Eastern or London Midland and Scottish trains could be used between Glasgow and Balloch and to some extent from and to Edinburgh, according to route.

Another round tour was similar, except that instead of Aberfoyle the coach service between Loch Katrine and Callander was used, with corresponding alteration in the services on that portion of the tour. Tours were also arranged utilising Clyde steamer services between Craigendoran and Arrocher, thence by road across to Tarbet to the Loch Lomond steamers or *vice versa*, and utilising the West Highland line to Ardlui (which for many miles passes directly along the shores of Loch

Glasgow	dep.	8.15 a.m.	10.59 a.m.	—	Train.
Balloch Pier	arr.	9.18 a.m.	11.45 a.m.	—	
Edinburgh	dep.	—	9.10 a.m.	—	Train.
Balloch Pier	arr.	—	11.58 a.m.	—	
Balloch Pier	dep.	9.25 a.m.	12.0 noon	—	Steamer.
Inversnaid	arr.	11.10 a.m.	1.45 p.m.	—	
Inversnaid	dep.	11.15 a.m.	2.15 p.m.	—	Coach.
Stronachlacher	arr.	12.15 p.m.	3.15 p.m.	—	
Stronachlacher	dep.	12.30 p.m.	3.20 p.m.	—	Steamer.
Loch Katrine Pier	arr.	1.15 p.m.	4.5 p.m.	—	
Loch Katrine Pier	dep.	1.20 p.m.	4.10 p.m.	—	Coach.
Aberfoyle	arr.	2.30 p.m.	5.40 p.m.	—	
			S.O.		
Aberfoyle	dep.	4.6 p.m.	5.49 p.m.	6.50 p.m.	Train.
Glasgow	arr.	5.38 p.m.	7.23 p.m.	8.23 p.m.	
Aberfoyle	dep.	4.6 p.m.	5.49 p.m.	6.50 p.m.	Train.
Edinburgh	arr.	7.32 p.m.	9.23 p.m.	10.45 p.m.	

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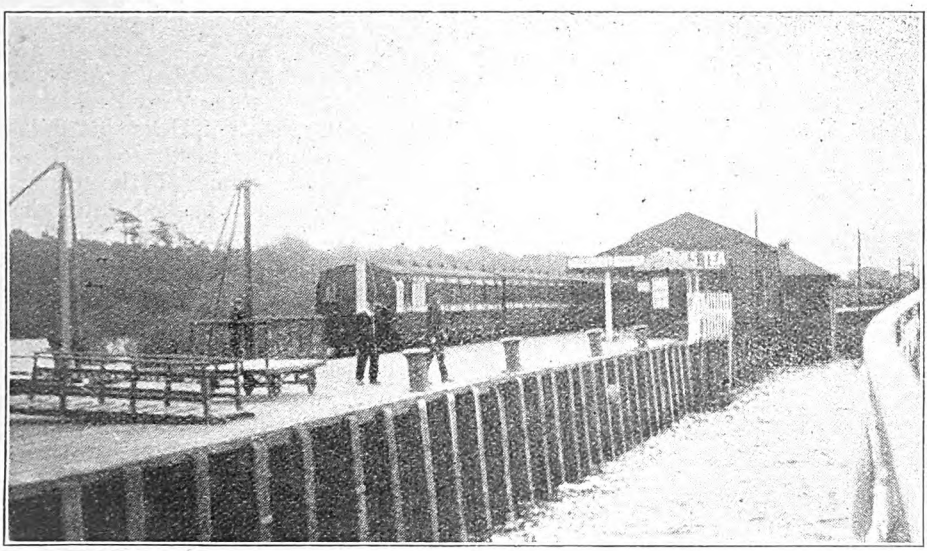
Lomond and affords magnificent views of the Loch) in one direction, travelling via Balloch and steamer the other way.

For service on Loch Lomond the Joint Committee owns six vessels. *Prince Edward* is the largest, 170 ft. in length and 22 ft. 1 in. beam, tonnage 304, and speed 15 knots. It has a passenger capacity of 958. *Prince George* and *Princess May* are 165 ft. in length, beam 21 ft., speed 14½ knots, tonnage 256, and passenger accommodation 871. *Empress* is a slightly smaller vessel, conveying 699 passengers, while *Princess Patricia* and *Queen Mary* are allowed to take 400 passengers each. *Prince Edward* and *Prince George* usually work the standard services, *Princess May* and *Empress* excursion and other special or relief trips, while *Princess Patricia* and *Queen Mary* run the short trips and pleasure cruises round the islands, &c. All are paddle vessels suited to the traffic for which they are employed, and have well-equipped saloons adapted for favourable observation purposes, together with roomy dining saloons where lunch, tea, light refreshments, &c., can be obtained. They have also good upper deck space, the favourite point of vantage in fine weather.

On arriving by train at Balloch Pier, the passenger has an immediate introduction to the scenic beauties before him. Ahead, "a magnificent panorama of water and hills stretches out as far as the eye can reach." Nearer, many fine houses overlook the Loch, while the adjacent waters are, during the season, dotted with craft of all kinds. A special feature of the Loch is the large number of picturesque islands distributed over its area, especially the wider stretches to the south. Proceeding further north the mountains close in, so that the passenger by steamer has ever-changing views before him. But whether yellow with gorse or purple with heather; with bare slopes down which picturesque waterfalls can be noted, or well-wooded; green with spring and summer foliage, or coloured with the gorgeous tints of autumn; the scenic beauties of the Loch must be seen to be realised. At times the wind sweeps down through the gorges, ruffling the waters of the Loch and possibly besprinkling the observer with windborne spray. Smooth and pleasant voyaging is, however, the general rule, and experience of other conditions merely adds to the interest of the cruise, while should there be rain or the wind be unpleasantly high, the saloons of the steamers are so well-windowed that one can enjoy the beauties of the trip almost as conveniently as on deck.



BALLOCH PIER STATION, FROM STEAMER.

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Leaving Balloch, the steamer crosses the broadest portion of the Loch. After calling at Balmaha the route becomes westerly across to Luss. The narrower portion of the Loch is then entered, and calls are made at Rowardennan, a convenient point for the ascent of Ben Lomond, 3,192 ft. The Loch then narrows still further, the mountains becoming higher and grander, "and the whole scenery as the vessel nears Tarbet, on the west side, is so remarkable that exclamations of admiration are called forth from all on board."

By this time the West Highland line has come into view on the west side and continues along the shore, usually fairly high up on the hill side, thence to Ardlui. At Tarbet passengers who have come across from Arrochar, on Loch Long, via the Craigendoran steamer, join the Loch Lomond steamer. Leaving Tarbet the steamer skirts the base of Ben Lomond, and then calls at Inversnaid, for the Falls of Inversnaid, and whence the coaches leave for Loch Katrine and Aberfoyle or Callander, as mentioned when referring to round tours. The final stage is to Ardlui, practically at the navigable head of the Loch. Here there is good hotel accommodation, while Ardlui station, on the West Highland line, is quite close.

Finally, while dealing with railway and railway-operated steamer facilities in this district, brief reference may be made to the Craigendoran and Helensburgh section of the London and North Eastern Railway. After leaving Dalreoch a short tunnel is traversed, as already mentioned, and Cardross station is reached. A short distance further and the line divides, one section leading to Craigendoran Low Level station, and the other to the High Level station used by West Highland trains. Adjacent to the former is a pier which has its own station, so that the numerous boat expresses required to meet the needs of the summer traffic can be placed alongside the Clyde steamers with which they connect. Beyond Craigendoran station the low level line continues to a terminus at Helensburgh (Lower), itself a favourite holiday resort and residential centre, while West Highland trains have another station, Helensburgh (Upper), as they continue north to Fort William and Mallaig. Some of the trains from Helensburgh are backed into the Pier station at Craigendoran to facilitate connection with the steamers, but most of the steamer services are provided for by special boat trains.

Ballach, Cardross, Craigendoran and Helensburgh are all favourite residential centres, while there are many regular travellers all the year round who use the

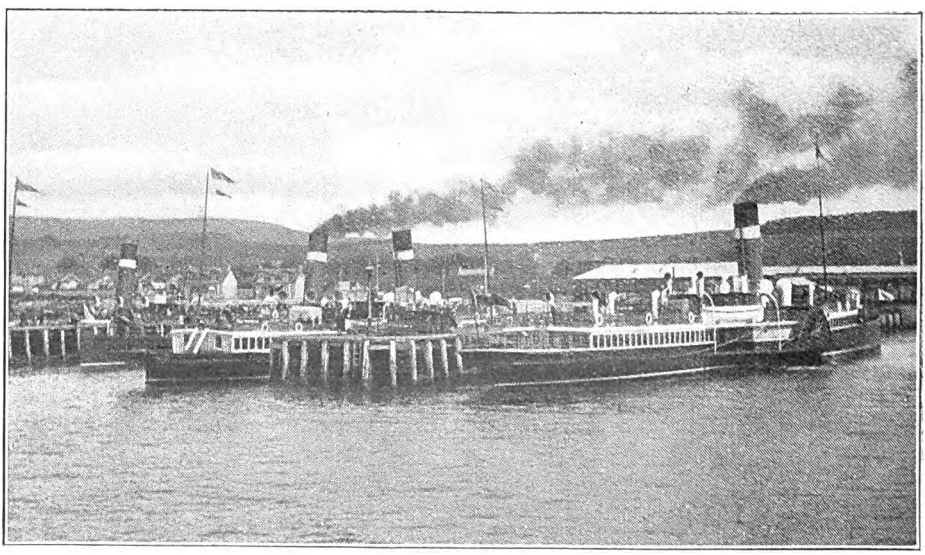

Photo.] [*Valentine, Dundee.*

LONDON & NORTH EASTERN RAILWAY STEAMERS AT CRAIGENDORAN PIER.

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Photo.] DUMBARTON CASTLE FROM THE PIER. [*Photochrom. Co. Ltd.*

steamers from Balloch or from Craigendoran for daily journeys or several times weekly. In the season such regular travellers are multiplied a thousandfold, it being a usual Scottish practice for families to take up their residence at these resorts for from one to three months, those members who have to come to Glasgow for business purposes travelling daily to and fro or as required. A special feature is the relatively low cost of travel combined with the fact that the distance from Glasgow is not great, so that access to one of the most beautiful yet most varied parts of Scotland is cheap, expeditious and convenient. Facilities are also provided from Edinburgh and other parts of Scotland, while through arrangements are available for the benefit of English visitors.

LOCOMOTIVE AND TRAIN WORKING IN THE LATTER PART OF THE NINETEENTH CENTURY.

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Under this heading Mr. E. L. Ahrons will deal with the Locomotives and Trains of the

SOMERSET AND DORSET JOINT RAILWAY

in the forthcoming RAILWAY MAGAZINE, February, 1924.

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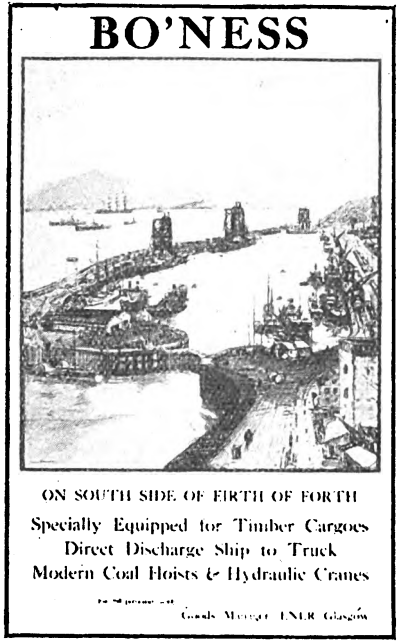
NEW DOCK POSTERS, LONDON AND NORTH EASTERN RAILWAY.

BURNTISLAND
ON NORTH SIDE OF FIRTH OF FORTH
Near the Rich Fifeshire Coalfields
Modern Coal Hoists and Cranes
Extensive Storage Accommodation
Goods Manager, LNER Glasgow

METHIL
ON NORTH SIDE OF FIRTH OF FORTH
Principal Coal-Shipping Port in Scotland
Modern Equipment Ensuring Rapid Handling
Goods Manager, LNER Glasgow


BO'NESS
ON SOUTH SIDE OF FIRTH OF FORTH
Specially Equipped for Timber Cargoes
Direct Discharge Ship to Truck
Modern Coal Hoists & Hydraulic Cranes

THREE dock posters in black and sepia recently issued by the London & North Eastern Railway Company are striking examples of up-to-date pictorial advertising. They are the work of Mr. Frank H. Mason, who is to be congratulated not only on the excellence of his style but also on the fact that these are calculated to make a widespread appeal to the business community. For boldness of treatment and all-round effectiveness the posters would be hard to beat. As the accompanying reproductions show, Burntisland, Methil and Bo'ness are severally dealt with, and the commercial advantages of those places are powerfully indicated by the artist.

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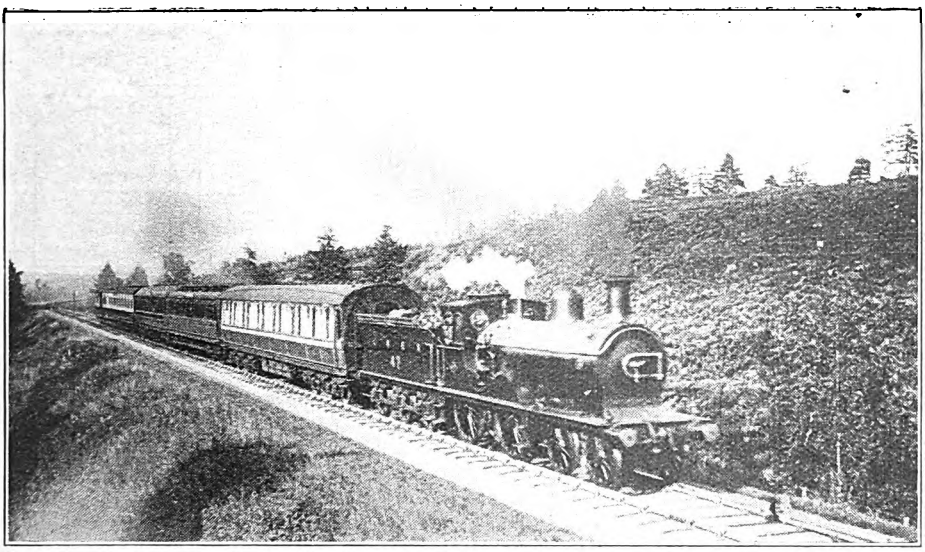

Photo.] LONDON AND NORTH EASTERN RAILWAY. [*W. Watt.*

Elgin–Aberdeen train, with West and East Coast Sleeping Cars and through carriages. Great North of Scotland 4-4-0 locomotive No. 47, "Sir David Stewart."

Through Carriage Services on Scottish Railways.

By "INDICATOR."

IN the January, 1923, number the principal Anglo-Scottish train services at that time, with consideration of the amplified facilities which had been given in the summer of 1922, were carefully analysed. The point of view then adopted was, however, mainly that of the prospective traveller from England. During 1923 there were, however, important improvements and accelerations, even of the standard services, together with useful additions to through facilities, as well as minor but valuable developments in connecting and associated trains. Further, though as yet to a limited extent only, the influence of grouping can be traced in the 1923 Anglo-Scottish services, as well as locally within the Northern Division of the London Midland and Scottish Railway and the Northern and Southern Scottish areas of the London and North Eastern Railway. Consequently, while to some extent this article covers the same ground as that published a year ago, the subject is now regarded mainly from the Scottish point of view, taking into account the developments of 1923, while attention is further given to through carriage services (other than those of a standard character) which do not come south of the border. Attention is confined, except for occasional remarks, to the 1923 summer arrangements, in that these included the highest developments of through carriage facilities. It must be borne in mind, however, that a large number of the Anglo-Scottish and many of the purely Scottish through carriage arrangements have an important business value all the year round, while many others cater for long-distance residential traffic other than that of a seasonal character. Consequently, a large proportion of the services to be considered are more or less permanent, though in some instances the winter times are slightly altered. The article is therefore written in the present tense, though the purely summer arrangements necessarily terminated in October, at the end of September or at specified earlier dates.

Dealing first with the Anglo-Scottish

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through services, it will be seen that, apart from the standard services by London Midland and Scottish and London and North Eastern routes between Aberdeen, Perth, Dundee, Glasgow and Edinburgh and London, there are many other through services from principal Scottish centres which call for attention. Thus, the London Midland and Scottish 12.30 p.m. from Aberdeen had a through carriage for Hereford, Bristol, Exeter, Plymouth and Penzance (at present this runs on the 1.0 p.m. and does not go beyond Plymouth), while the 7.50 p.m. has a through carriage for Liverpool, and on Thursdays takes a through carriage for Southampton. This latter vehicle, together with one from Glasgow, runs attached to a London train, and is worked special from Willesden Junction to Waterloo, where it is sent forward with the Southern Railway boat train for Southampton. These through coaches are run principally for the convenience of Scottish passengers for various liners from Southampton. Similarly, the London and North Eastern Railway includes through vehicles for Penzance (with through sleeping car) on the 9.50 a.m. from Aberdeen, serving also Sheffield, Nottingham, Leicester, Banbury, Swindon, Bristol and Plymouth, while there are coaches for Sheffield by the London and North Eastern route on the 12.50 p.m. In association with the Midland Division of the London Midland and Scottish Railway the 6.15 a.m. and 5.45 p.m. trains for St. Pancras provide through facilities *via* the Midland route.

In the case of Dundee the only London Midland and Scottish through services to England are those to London, except that connection is made with all the others at Perth, but the London and North Eastern route gives the same facilities as from Aberdeen. Edinburgh and Glasgow are, however, the great through carriage centres. From Princes Street, Edinburgh, the 10.0 a.m. has a through carriage for Birmingham, and the 10.0 a.m., 1.30 and 4.10 p.m. have through vehicles for either Exchange or Victoria stations, Manchester, and Exchange station, Liverpool. The great Mersey port also has a through section on the 10.30 p.m. from Princes Street, Edinburgh, to Lime Street station. The East Coast route from Edinburgh (Waverley), besides including all the Aberdeen and Dundee facilities, had a through carriage for Harwich (in connection with the Continental steamers thence) and to Southampton, for the liners from that port.

From and to London through carriages with sleeping car were introduced during last year's summer season between London (King's Cross) and Elgin and Lossiemouth, *via* Aberdeen and the Great North of Scotland section of the London & North Eastern Railway, and at a somewhat later date similar facilities were given from London (Euston) by the West Coast route to Aberdeen.

From Glasgow (Central) the 10.0 a.m. London train also conveys Birmingham vehicles, and includes a North to West section *via* Shrewsbury and Hereford to Bristol and Plymouth. The 10.10 a.m. is primarily a through Liverpool and Manchester express, also taking in the summer season a Southport vehicle. The 1.30 p.m. includes Liverpool and Manchester sections, also in the season conveying a through vehicle for Blackpool. The 4.10 p.m. is another Liverpool and Manchester express, while the 5.30 p.m. includes vehicles for the North to West route and as far as Exeter in the south-west. The 11.5 p.m. has Liverpool and Manchester sections. On Thursdays the 10.30 p.m. London train takes the through Southampton coach, as already mentioned. In addition to the Glasgow (Central) services, the 9.20 a.m. and 5.30 p.m. from St. Enoch have Birmingham and Bristol vehicles, while the 12.0 noon conveys one for Manchester (Victoria).

From Glasgow (Queen Street) the London and North Eastern Railway similarly provides through facilities on the 8.40 a.m. for Southampton, Harwich, and stations on the Great Central route; on the 12.5 p.m. for Leeds, the Great Central route, and through to the Great Western system, with Penzance as the final destination; and the 4.0 p.m. is another through Leeds service. There is no need to specify the north-bound services in detail, in that this article is primarily concerned with the extent to which such facilities are available from the North, rather than with their details, especially in view of last year's relatively complete review of the standard services. Study of the diagrammatic map reproduced indicates,

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however, the wide range thus covered. Glasgow and Edinburgh passengers are, indeed, able to travel by through carriages, if not complete trains, at least once daily (and that at a time suited to the convenience of the average traveller), if not more often, and sometimes with a choice of route or service. It must be remembered, too, that in most cases, although from, say, Aberdeen or Dundee, there may not be a through carriage for the destination in view, it is possible to transfer, while travelling, to a desired through vehicle attached during the journey.

has modified ownership conditions, there have been no appreciable withdrawals of pre-grouping through and associated services, while in other respects there have been important developments, particularly in regard to through services and connecting facilities. The analyses of the through services given in panels applying to the principal Scottish stations are worthy of careful study in this connection.

The Anglo-Scottish services constitute, however, one section only of the material under review, and it is now necessary to consider through services operated wholly

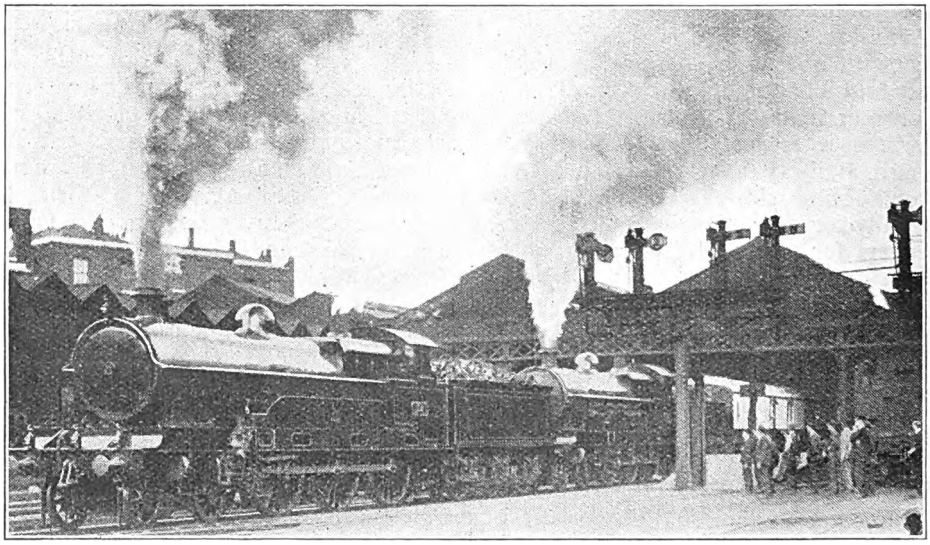

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*F. E. Mackay.*

Royal train leaving Euston for Ballater.
London & North Western 4-6-0 four-cylinder locomotives Nos. 32 and 42.

It is interesting to note, too, how far these facilities are now available within the limits of one or other of the two great grouped railways, or by their association individually with the Great Western or Great Western and Southern Railways. Before grouping, the Midland Railway had associations with both the Glasgow and South Western and North British Railways, the East Coast companies had through services to the Highland line, and in places the component companies had working arrangements, &c., between themselves in regard to aspects combining the interests of both of the great northern companies, and, in the main, these are still retained. In fact, although grouping

north of the border. These, as far as Glasgow and Edinburgh are concerned, are graphically shown on pages 26 and 27. In a few instances, chiefly for completeness, through services of a standard character are shown, but otherwise only unusual or noteworthy services are indicated, in that there are so many train working routes and their numerous variations that full presentment would almost require the complete Scottish railway systems to be set forth, except for branch lines without through trains.

It will be noted that the London Midland and Scottish Railway figures most prominently in regard to Glasgow, with, however, the London and North Eastern

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as a very good second, while at Edinburgh the situation is reversed. From Glasgow (Buchanan Street) the principal through services are worthy of analysis, as follows :—

4.15 a.m. (from Glasgow Central) Limited Express to Oban and Aberdeen, with Dundee and Inverness connections, and taking on, from Stirling, the West Coast Penzance-Aberdeen through coach.

7.15 a.m. Aberdeen Pullman Car Express with Dundee connection.

8.0 a.m. Through train to Oban.

taurant car is attached), one section travelling *via* Grantown-on-Spey, Forres and Nairn to Inverness, and the other *via* Carr Bridge. There is also a through carriage for Aberfeldy, detached at Ballinluig.

10.25 a.m. Through train to Alloa and Denny.

12.0 noon. New Pullman Car Express for Aberdeen. Through carriage to Crieff and Comrie *via* Gleneagles.

12.10 p.m. Through train to Oban.

1.5 p.m. (Saturdays only). Through

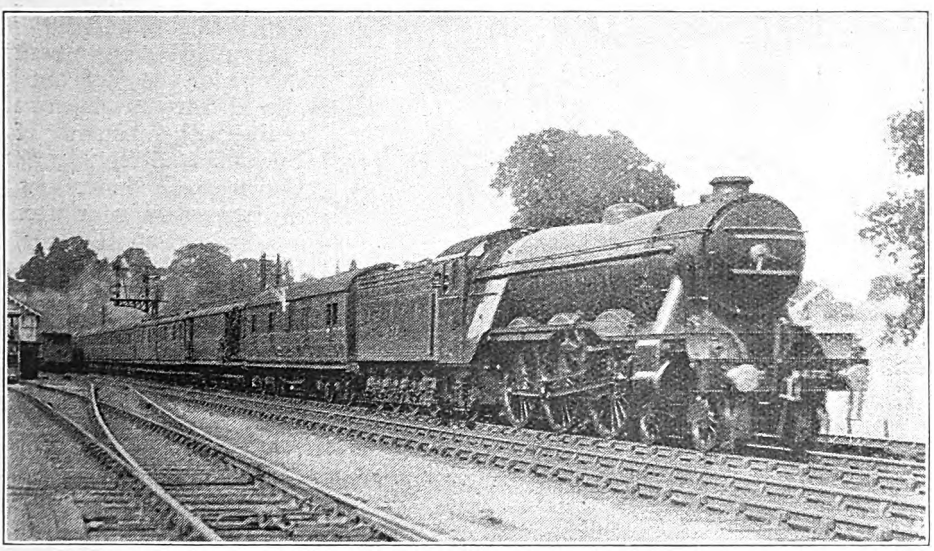

Photo.] LONDON AND NORTH EASTERN RAILWAY. [*F. E. Mackay.*

Up East Coast and Mail Express.
Great Northern 3-cylinder 4-6-2 locomotive No. 1472.

8.45 a.m. Through train to Crieff, Comrie and Balquhidder.

9.15 a.m. Through express to Dundee.

9.45 a.m. Through train to Oban, with Pullman Observation Car at the rear and with a through carriage for Loch Tay, detached at Killin Junction and running down to the pier to connect with the Loch steamers.

10.0 a.m. Aberdeen Pullman Car Express with Dundee connection. This train also has a through carriage for Keith, Craigellachie and Elgin *via* Aberdeen.

10.10 a.m. Special Highland express (usually worked by Highland engine throughout), travelling *via* Aviemore (to which station a through Pullman express to Crieff, Comrie and Balquhidder *via* Gleneagles.

1.30 p.m. Aberdeen Pullman Car Express with Dundee through section.

1.40 p.m. Through express to Inverness *via* Forres (except Saturdays) and *via* Carr Bridge, with through carriage for Aberfeldy. Also through carriages to Callander and Dundee.

4.0 p.m. Through express for Crieff *via* Gleneagles and Callander, detached at Stirling.

5.0 p.m. Aberdeen Pullman Car Express with Dundee through section. Through carriages to Crieff and Comrie *via* Gleneagles.

5.10 p.m. Oban Pullman Car Express.

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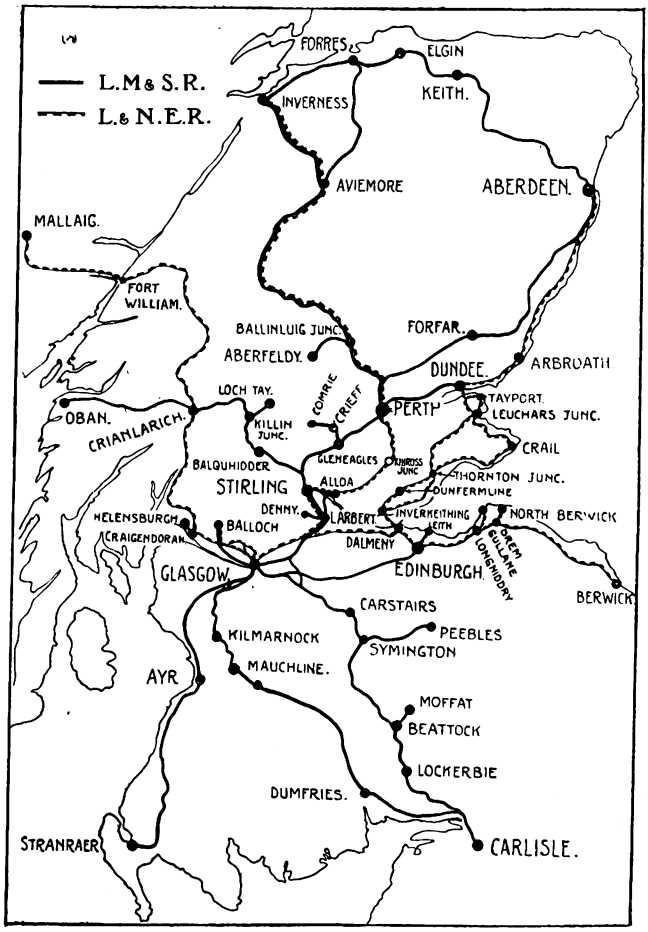

DIAGRAMMATIC MAP SHOWING L.M.S. & L.N.E. THROUGH CARRIAGE SERVICES FROM GLASGOW.

5.30 p.m. Through train to Denny.

6.5 p.m. Through express for Aberdeen with through sections for Dundee and Callander.

8.0 p.m. Through train to Callander on Saturdays.

10.0 p.m. Sleeping car train to Inverness, connecting at Perth with London-Aberdeen express, which takes on Glasgow-Aberdeen through vehicles. This train also has a through carriage for Callander.

In the opposite direction there are through trains or through carriages to Glasgow from Aberdeen at 6.50 and 10.30 a.m., and 12.10, 12.30, 3.25, 5.30 and 7.50 p.m.; from Aberfeldy at 9.20 a.m. and 5.20 p.m.; from Alloa at 8.27 a.m.; from Callander at 7.55, 8.31 a.m., 12.8, 2.53, 6.32 and 8.20 p.m.; from Crieff at 8.8 a.m., 2.28 and 4.30 p.m.; from Dundee at 8.0, 10.20, 11.30 a.m., 2.25, 4.45 and 7.0 p.m.; from Elgin (*via* Aberdeen) at 9.35 a.m.; from Inverness at 10.30 a.m., 3.30 and 11.20 p.m. *via* Carr Bridge, and at 9.10 a.m. and 2.0 p.m. *via* Forres; from Loch Tay at 6.35 p.m.; from Moffat at 7.28 a.m.; from Oban at 5.40, 9.10, 11.15, 11.50 a.m., 3.35 and 5.15 p.m.; and from Peebles at 7.40, 9.45 a.m. and 5.30 p.m.

From Glasgow (Central), except for the fact that certain Aberdeen trains are there dealt with instead of at Buchanan Street, for convenience of connections, all the trains calling for attention are directed southwards, and these, apart from the English services, are not numerous, so far as through vehicles of a special character are concerned. The most numerous are the Peebles trains, of which there are six distributed throughout the day, the principal being those catering for residential traffic, on Saturday afternoon or in the neighbourhood of 5.0 p.m. There are also through services to the Moffat branch *via* Beattock at 12.45 p.m. (Saturdays only) and 4.45 p.m. (Saturdays excepted). Although there are not many of these special through services south of Glasgow, both the Caledonian and the Glasgow and South Western (from St. Enoch) sections have, of course, a very wide variety of services on various routes of a standard character.

In the case of the London and North Eastern Railway the principal through services, other than those of a suburban character, are those to Craigendoran, Helensburgh and Balloch, and to Fort William and Mallaig, to Perth *via* Alloa, and Dundee, Aberdeen and the Fifeshire lines *via* the Forth Bridge, and to Leith, Gullane and North Berwick *via* Edinburgh. Dealing with the last-mentioned

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first, principal interest attaches to the summer Lothian Coast Restaurant Car Expresses. The west-bound train leaves North Berwick at 8.5 a.m. and Gullane at 8.2 a.m., and gives an arrival in Glasgow at 9.50 a.m. In the opposite direction Queen Street is left at 12.25 p.m. on Saturdays and at 3.50 p.m. on other days.

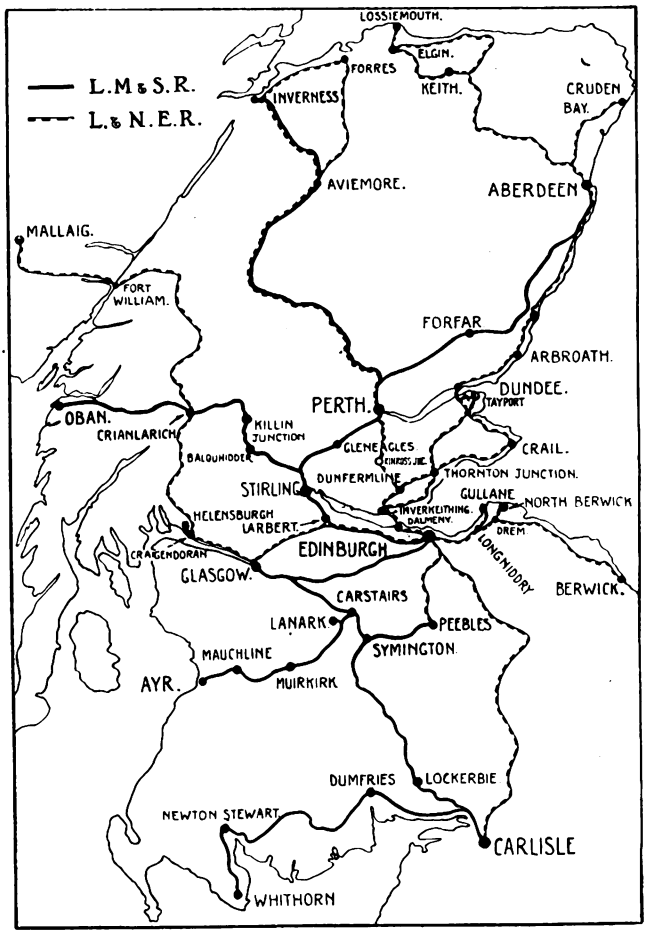
North of the Forth the principal services from Glasgow by the London and North Eastern route are those to the Fife coast lines, by various routes, and to Aberdeen. These services from Glasgow (Queen Street) may be briefly summarised thus :—

8.0 a.m. Through train to Dundee *via* Dalmeny, Dunfermline, Thornton Junction, Ladybank Junction, Leuchars Junction and Tayport.

9.40 a.m. Through carriages for Aberdeen attached to Edinburgh-Aberdeen restaurant car express at Dalmeny.

12.11 p.m. Through train to Dundee *via* Dunfermline, but not deviating from the direct route *via* Tayport.

1.22 p.m. Through express to Crail with through carriage for Aberdeen attached to Edinburgh-Aberdeen restaurant car express at Dalmeny.



DIAGRAMMATIC MAP SHOWING L.M.S. & L.N.E. THROUGH CARRIAGE SERVICES FROM EDINBURGH.

4.10 p.m. Dundee express *via* Dunfermline and with " Fifeshire Coast Express " portion for Crail detached at Thornton Junction.

There are, of course, other trains from Glasgow proceeding north of the Forth Bridge and providing connections for various services.

In the opposite direction the most interesting trains with through facilities for Glasgow are the 7.6 a.m. Fifeshire Coast Express from Crail, combined at Dalmeny with a slow portion in advance from Thornton Junction; through carriage from Aberdeen to Glasgow on the 6.15 a.m., detached at Kirkcaldy; Dundee at 7.56 a.m. *via* Crail and Dunfermline; 1.50 p.m. through train from Arbroath to Glasgow, connecting with the 12.50 p.m. from Aberdeen to convey a through carriage for Glasgow; from Crail at 2.38 p.m. *via* Cowdenbeath; from Dundee at 2.15 p.m. *via* Crail; 6.12 p.m. from Thornton Junction, connecting at Dalmeny with the 3.40 p.m. from Aberdeen to take forward Glasgow through carriage; and similar connections between the 7.57 p.m. from Thornton Junction *via* Dunfermline and the 5.45 p.m. *ex*-Aberdeen.

To Perth the Glasgow trains usually travel *via* Alloa to Kinross Junction, the principal being the 9.0 a.m., 1.52, 4.47 and 7.30 p.m., and from Perth at 8.3 a.m., 1.7, 4.20 and 7.35 p.m.

Dealing now with the Edinburgh

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services, the London Midland and Scottish Railway provides several interesting examples from Princes Street. Connecting at Larbert with north trains, and utilising running powers over the London and North Eastern Railway between Haymarket and Falkirk, there are through services to Aberdeen at 9.25 a.m., 1.10 (or 1.15) and 4.25 p.m.; to Oban at 6.45, 9.25, 11.30 a.m. and 4.25 p.m.; and to Callander also at 12.50 p.m. on Saturdays; to Crieff and Comrie at 8.30, 9.25 a.m. and 4.25 p.m.; and to Perth (in addition to other services) at 9.45 p.m. Southwards an interesting service is that given at 10.10 a.m. and 4.40 p.m. (not Saturdays) to Ayr, *via* Carstairs, Lanark, Muirkirk and Mauchline. There are also services to Peebles at 4.40 and 5.35 p.m. (except Saturday), and at 5.45 p.m. on Saturdays; to Whithorn at 11.45 a.m. *via* Carstairs, Beattock, Lockerbie, Dumfries and Newton Stewart; and to Lanark at 8.55, 10.10 a.m., 12.50 (or 12.53) and 4.40 (not Saturday) p.m. The routes taken by some of these trains are interesting.

On the London and North Eastern Railway, Edinburgh (Waverley) being the centre of the Southern Scottish (late North British) section, there is, naturally, a wide variety of through services in all directions, though many of these are of too local a character, or due merely to the many alternative routes available, to call for attention. Northwards, it will be advisable to tabulate the principal services of interest in this connection.

4.15 a.m. Through express from London to Aberdeen, with through carriages and sleeping car for Elgin and Lossiemouth.

7.35 a.m. Through express, London to Dundee and Aberdeen.

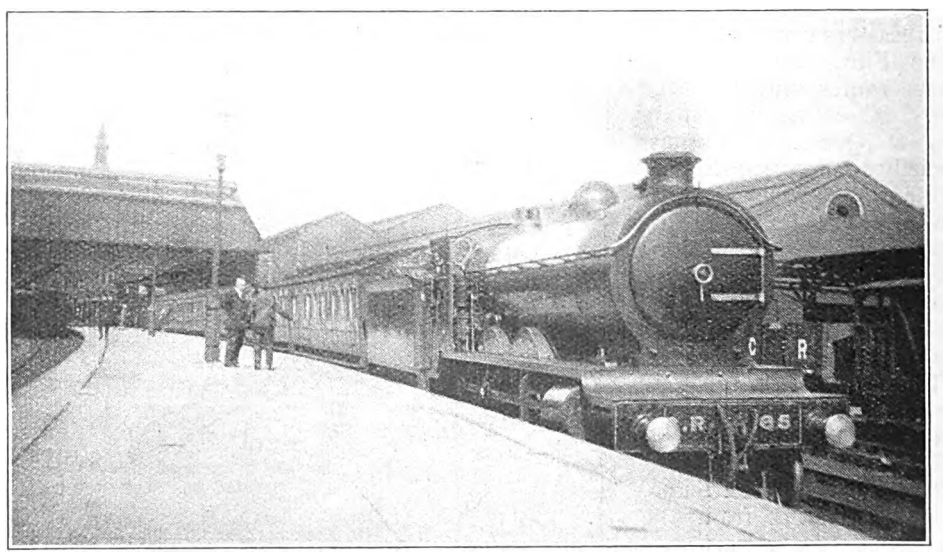

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Tom M. L. Neish.*

4.45 p.m. Glasgow express at Dundee (West), with through carriages for Aberfeldy, Blair Atholl and Balquhidder. Caledonian 4-6-0 locomotive No. 65.

9.0 a.m. Dundee *via* Crail.

9.30 a.m. Burntisland, Kirkcaldy, Thornton, East of Fife, etc.

10.20 a.m. Dundee and Aberdeen Restaurant Car Express, with through carriages to Keith, Craigellachie, Elgin and Lossiemouth.

10.30 a.m. Dundee *via* Tayport, otherwise direct.

12.20 p.m. Dundee *via* Tayport, otherwise direct.

12.53 p.m. (Saturdays only) to Crail.

1.10 p.m. to Montrose direct.

1.16 p.m. To Dunfermline, Alloa, Stirling, with connections to Devon Valley and Forth and Clyde lines.

2.0 p.m. Restaurant car express to

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Aberdeen, with a through carriage to Cruden Bay on Fridays.

3.40 p.m. Through train to Perth *via* Ladybank Junction.

4.15 p.m. Through train to Dunfermline, Alloa and Stirling with connections to Devon Valley and Forth and Clyde lines.

4.25 p.m. Through train to Aberdeen.

4.52 p.m. "Fifeshire Coast Express" to Crail.

5.12 p.m. To Dundee *via* Crail.

6.33 p.m. Dundee and Aberdeen restaurant car express.

and 6.50 p.m. (Saturdays only) from Crail.

On the Perth line there are several important Highland expresses, notably the sleeping car trains, and the 10.7 a.m. (through coaches to Inverness *via* Aviemore and *via* Carr Bridge), 1.52 (through coaches to Inverness each way and restaurant car to Blair Atholl) and 6.39 p.m. trains. Southbound, the principal services are the Highland connections from Inverness at 8.40 a.m. and 2.0, 3.30, 4.15 and 4.30 p.m., and the 8.40

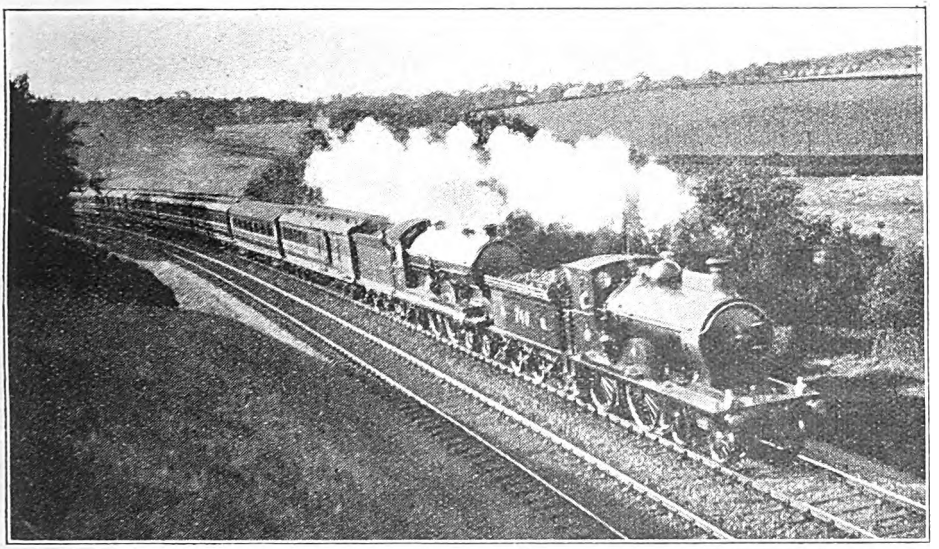

Photo.] LONDON AND NORTH EASTERN RAILWAY. [*C. J. L. Romanes.*

Up Anglo-Scottish express near Reston.
North British 4-4-0 locomotive No. 470, and North Eastern 4-4-2 locomotive No. 697.

6.38 p.m. Through train to Dunfermline, Alloa and Stirling.

8.10 p.m. Dundee express.

Principal up trains are: 6.50 a.m. from Leven (Fife Coast line), 6.10 a.m., 7.15, 8.40 a.m., 3.6, 4.10 and 6.24 p.m. from Dundee direct; 6.15, 9.50 a.m., 12.50 (with through carriage from Lossiemouth and Elgin to Edinburgh), 3.40, 5.45 and 7.35 p.m. (the last mentioned with through vehicles and sleeping car from Lossiemouth and Elgin to King's Cross) from Aberdeen; 8.20 a.m. and 7.32 p.m. from Montrose; 8.57 from Arbroath; 11.30 a.m. from Anstruther; 12.30 and 2.15 p.m. from Dundee *via* Tayport, otherwise direct; 2.38 from Crail *via* Cowdenbeath; 7.6 a.m. a.m., 12.15, 3.35, 7.53 and 9.20 p.m. expresses from Perth.

These northern lines might be further considered, were space available, in view of the many connecting lines in the Fifeshire district. Reference may, however, be made to Mr. J. F. Gairns' article on the "Fife Coast Lines" published in the April, 1923, number of the RAILWAY MAGAZINE.

Dealing now with the more southern lines of the London and North Eastern Railway, there are, associated with the Berwick main line, through trains from Edinburgh to Gullane, North Berwick, &c., but these need not be considered in detail. On the Waverley route there are through trains to several auxiliary

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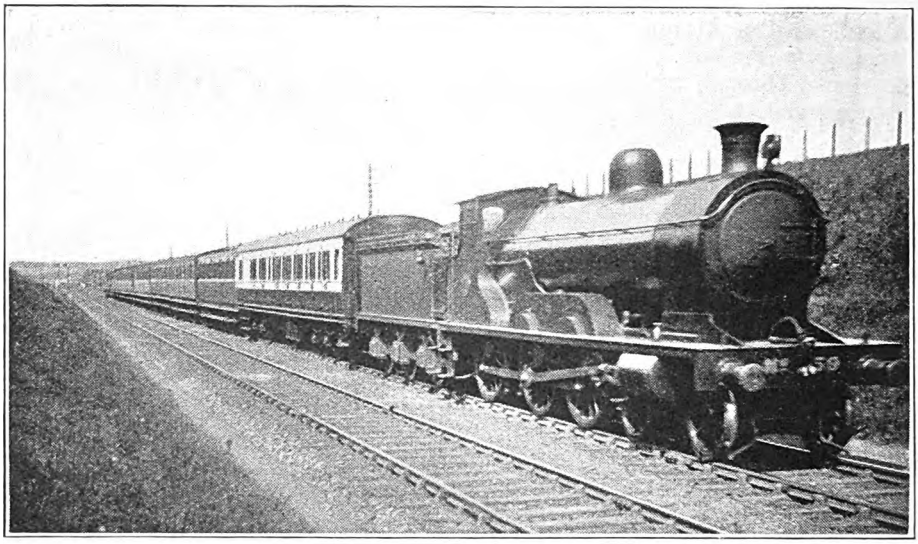

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Henry L. Salmon.*
Inverness-Glasgow express near Perth. Highland 4-6-0 locomotive No. 59, "Foulis Castle."

routes, but the only ones calling for special attention are the "Peebleshire Expresses" from Waverley at 1.19 p.m. (Saturdays only) or 5.21 p.m. (Saturdays excepted), to Galashiels *via* Peebles, the inwards train leaving Galashiels at 8.12 a.m. Certain of these trains convey through vehicles between Edinburgh and Selkirk.

A few other services also call for reference, notably the 9.10 a.m. from Edinburgh to Aberfoyle, returning at 5.50 p.m. in connection with the "Trossachs" tours; trains between Perth and Dundee and through to Arbroath; one or two seasonal trains through from Edinburgh to Craigendoran and Helensburgh; and a through service from Edinburgh at 10.5 a.m. to Fort William and Mallaig, returning on the 2.0 p.m. from Mallaig.

Finally, reference must be made to the Aberdeen-Inverness through trains leaving Aberdeen at 7.45 a.m. and 2.30 p.m., and Inverness at 1.0, 3.35 and 6.0 p.m.; and the Dundee services at 1.10 (Saturdays only) and 4.45 p.m. (except Saturdays) to Aberfeldy and Blair Atholl, at 4.45 p.m. to Balquhidder, and at 9.30 a.m., 1.10 (Saturdays only) and 4.45 p.m. to Crieff.

Allowing for the fact that some of these services are not required in the winter months, a large proportion still remain in the present time-tables, in some cases with modifications in running or at slightly altered times. There are also, during the summer, a number of special through trains to favourite holiday resorts, especially at "month-ends," but these are somewhat outside the present subject, though they would afford interesting material for study.

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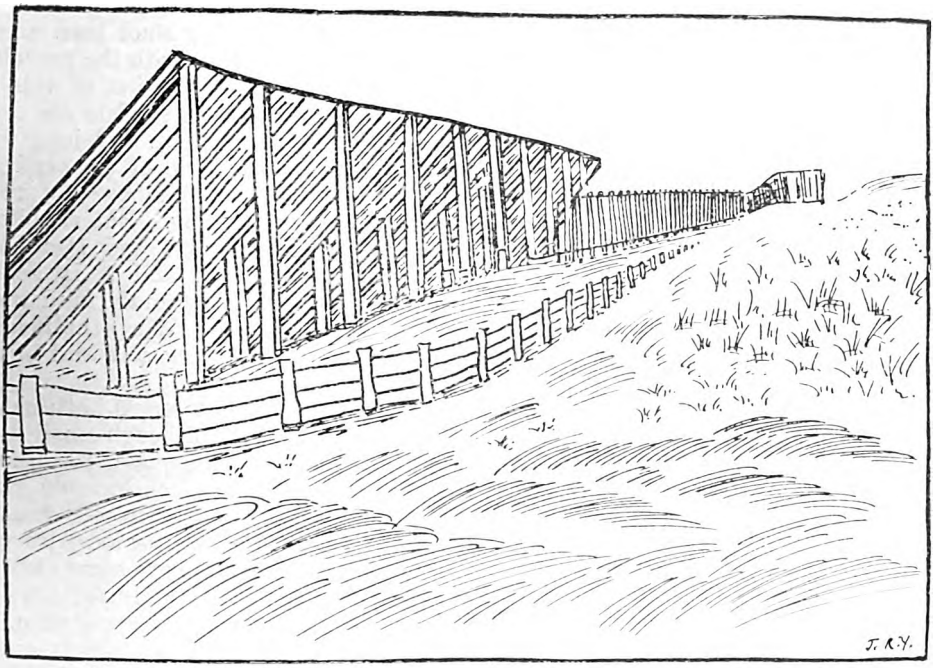

SAND BLOWER AS USED ON THE BURGHEAD BRANCH, L.M. & S.R.

Sand Drifts on a Scottish Railway.

By JAMES R. YOUNG.

REFERENCE has on several occasions been made to the snow difficulty on Scottish railways, but almost as much trouble is experienced, in places, with sand, with the further disadvantage that it is liable to occur at any time during the year, and not merely during the winter season. One of the places which suffers very severely in this respect is the Burghead and Hopeman branch of the Highland section of the London Midland and Scottish Railway, joining the Forres-Elgin line at Alves Junction.

On this branch sand has been a source of considerable trouble for many years past, particularly at a point about a hundred yards south of Burghead station. The shore is here bordered by numerous sand hillocks, and whenever a strong westerly wind prevails, the line is invariably blocked with sand drifts, despite the fact that zinc erections called "blowers" have been erected as a means of overcoming the difficulty. The line is bordered by sand hills on either side and these "blowers" extend for over 2 miles.

Where the sand came from it is difficult to say, but at one time it probably formed a long sandstone ridge. Historians declare that centuries ago the area comprising the sand hills, together with Burghead bay, was once part of a forest. Evidence of this was obtained in the discovery of fragments of tree trunks in fishermen's nets many years ago. It is just possible that the sand may have come from the district of Culbin, beyond Findhorn (a village located about eight miles farther west), where in the seventeenth century the estate of Culbin was completely buried during a hurricane. The Culbin sand hills are much larger than those beside the Burghead line, and the former are shifting sands, while the latter, apparently, are not.

During a terrific westerly gale which swept over this district centuries ago, drifts of sand are recorded to have been carried by the wind as far as Roseisle, a

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low-lying district about two miles east of Burghead where a lake is said to have existed. This lake was completely filled up. On this occasion, too, the sea made great inroads. It was, at one time, possible to walk along the seashore from Burghead to Findhorn almost in a straight line, but this cannot now be done for the reason that, during the last 50 years, the sea has been gradually encroaching on the west shore of Burghead. Instead of making nearly a straight line as it once did, the water's edge now forms a large semi-circle when the tide is in. This is entirely due to the inroads made by the sea. Curiously enough, the sea is also encroaching on the east shore, and some of the older inhabitants of the seaport consider that their town may in the course of time become an island in miniature.

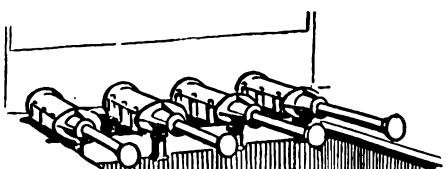
Sand has always been a nuisance more or less to the railway people at Burghead. During the second week in October, 1923, a violent north-easterly gale swept over the Moray Firth, and the sand drift trouble on the Burghead line was renewed.

The zinc structures, some of which are about 12 ft. in height, proved insufficient to prevent the sand getting on to the line. The result was that, in a few hours, large sand drifts had accumulated. A squad of railway men had necessarily to be brought to the scene, but the line was cleared of sand only after five hours of very strenuous work. Similar operations had to be undertaken several times during the year.

A branch line runs along the east side of the chemical works, near the railway station. Part of an old line—the original one when the railway was first opened about half a century ago—is still in existence, but it has long since been unused. In the course of time, with the prevalence of westerly winds, a portion of this line has been covered with sand to the extent of several feet. "Bent," or long grass, grows freely upon some of the sand hills, and to some extent this helps to prevent the sand from drifting. But rabbits are very numerous in this and also in the surrounding district, and it is believed that rabbit holes are often the fundamental cause of sand drifts. When the holes are formed the sand, being soft and light, is blown by the wind.

The Burghead line serves both sides of the harbour which, although small and in many respects inadequate for modern traffic, deals with a considerable timber trade, besides which chemicals, coal and materials are imported for local purposes. The branch also suffers to some extent in that fields in the Alves district are sometimes flooded in times of heavy rain.

Beyond Burghead the branch extends for two miles to the fishing village of Hopeman. Before the Hopeman line was opened, over 30 years ago, travellers from this village and also from neighbouring districts had to walk to Burghead. The extension was a great consolation to at least one inhabitant of Hopeman—a fisherman—who, it was said, was the "waur o' a dram" on one occasion at Burghead railway station. He stepped on to the platform just in time to see the train move off. But the fisherman, nevertheless, seemed a little complacent, despite his disappointment, for he exclaimed, evidently addressing the train: "Ye can gang, ye can run, confoond ye; we'll seen hae a trainie o' wer ain." And not long afterwards, the Burghead line was extended to Hopeman.



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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

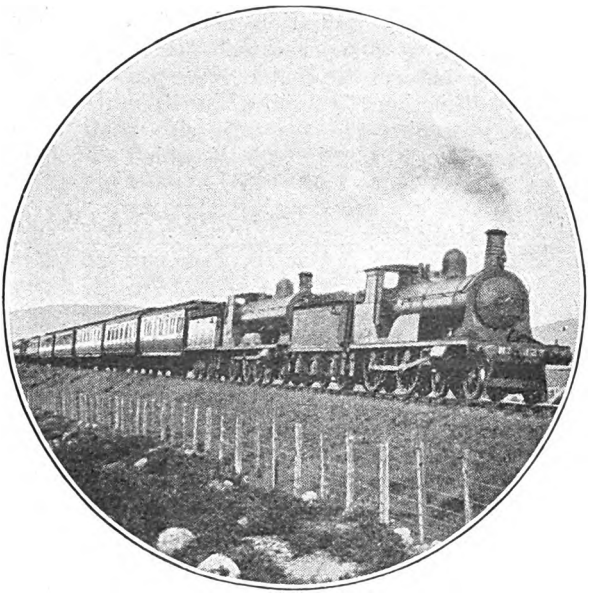

Photo.] [*C. J. L. Romanes.*

LONDON MIDLAND AND SCOTTISH RAILWAY.

Inverness, Perth and South train near Dalwhinnie. Highland 4–4–0 locomotive No. 123, "Loch an Dorb," and 4–6–0 locomotive No. 128, "Thurso Castle."

JANUARY has become traditionally a month devoted to the consideration of Scottish railways in these pages, and we will therefore, without further ado, proceed north of the Border in order to examine some of the locomotive work which is being performed nowadays on the northern sections of our large groups. As, amongst the larger systems, the Caledonian section of the L.M.S. group has had the least proportionate attention in these columns during the last year, Caledonian runs shall take the first place in the present article. Merit in Scottish locomotive work is generally determined by the ability of an engine to surmount gradients. Level stretches of line, such as those between Forfar and Perth on the Caledonian, or Cowlairs and Edinburgh on the North British, or Glasgow and Ayr on the Glasgow and South Western, are rare indeed amongst the extensive railway mileages of Scotland. High speeds on falling gradients are uncommon; either because the gradients themselves are unsuitable for speed exhibitions, or because Scottish drivers have an instinctive objection to fast travelling for its own sake. This latter disinclination is especially noticeable on the Caledonian section between Beattock and Carlisle, coming south, or between Summit and Carstairs, going north, where, over long stretches of line, inclined downwards at 1 in 200 or thereabouts and admirably laid out for speed, the high maxima of former days have given place to speeds rarely reaching 70 m.p.h., and more generally averaging about 60. No exception can be taken to such a practice, of course, if the uphill work has been good, and if overall times are being maintained—good uphill travelling in order to avoid excessive speeds downhill is, indeed, desirable—but when an express is running late such downhill caution seems quite indefensible.

I have a large number of timed Caledonian journeys not hitherto described in these columns, but a number of them lack any special distinction, and may be dismissed more or less briefly. From the performance standpoint the most interesting were those on the Northern section of the line, where, I am inclined to think, the most notable locomotive work on the system is often found. The down "Postal" is a train of rigidly restricted weight, and, when last I joined it at Perth, was made

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up a four-coach formation of 125 tons gross only. Non-superheated McIntosh 4–4–0 No. 144 was the engine. We passed Stanley Junction, 7·2 miles, in 10 min. 25 sec., despite the five-mile rise past Luncarty, on the 1 in 125 of which (2 19 min.; Alyth Junction, 20·5 miles, in 23¼ min., and Forfar, 32·5 miles, in 34 min. 20 sec., at slightly reduced speed. On to Guthrie speed again gradually mounted to 67 m.p.h., and further to 69 on the "dip" between there and Glaisterlaw, but was

L.M.S. (CALEDONIAN) RAILWAY.—CARLISLE–GLASGOW.

Distance.	Train.	3.56 P.M.			3.30 P.M.			12.51 P.M.		
	Engine : 4-4-0 No.	Schedule.	136 DN	136 DN	Schedule.	140 DS	46 MS	Schedule.	‡116 PS	*69 PS
	Load (axles)		26	38		42	42		54/58§	58/62§
	,, (tons tare)		185	267		284	284		363/400§	—
	,, (tons full)		195	280		300	300		390/430§	425/455§
Miles.		min.	m. s.	m. s.	min.	m. s.	m. s.	min.	m. s.	m. s.
0·0	Carlisle	0	0 00	0 00	0	0 00	0 00	0	0 00	0 00
8·6	Gretna	11	11 00	12 00	11	11 05	11 25	11	10 35	10 22
16·7	Kirtlebridge ..	21	21 05	23 00	21	20 45	21 45	22	20 35	19 59
22·7	Castlemilk Box ..	—	27 25	30 25	—	27 45	28 20	—	27 20	26 36
25·8	Lockerbie	¶31	pass	pass	31	31 40	32 10	32	31 20	30 09
		32	31 15	33 35	34	33 30	33 50	35	34 20	0 00
34·5	Wamphray ..	—	39 25	42 05	—	44 45	45 00	—	44 45	10 43
39·7	Beattock†	pass	pass	48 15	52	50 45	51 00	52	50 40	16 40
		48	45 05	50 05	55	52 45	53 00	54	53 25	‖ 0 00
45·2	Greskine Box ..	—	54 45	60 40	—	65 05	64 30	—	66 20	10 56
49·7	Summit Box ..	69	63 40	68 15	77	74 20	72 40	75	75 30	18 40
									p.w.r.	
52·6	Elvanfoot ..	—	67 05	71 35	—	77 55	76 05	—	79 15	21 53
63·2	Lamington ..	—	78 50	81 45	—	88 50	87 20	—	91 10	32 57
66·9	Symington	pass	pass	pass	pass	pass	pass	92	95 45	37 35
		86	83 20	85 55	94	92 20	91 15	94	98 20	0 00
70·0	Leggatfoot Box	—	86 55	89 20	—	95 20	94 15	—	103 25	5 25
73·5	Carstairs	pass	sigs.	pass	103	99 45	98 40	104	107 55	9 54
		94	91 10 sigs.	93 05	109	106 35	106 55	109	113 30	—
76·3	Cleghorn ..	97	96 10	97 15	113	112 15	113 00	113	118 50	—
84·1	Law Junction ..	108	sigs.	106 40	123	121 50	sigs.	122	127 50	—
89·5	Motherwell	¶116	116 25	113 00	132	129 00	135 30	pass	pass	
		117	117 15 sigs.	113 55	134	129 45	136 30	130	134 10	—
102·3	Glasgow	139	138 55	133 50	155	149 15	156 00	149	151 40	—
102·3	Net running times (min.)	137	130	131	141	137¾	137	137	135	—

¶ Conditional stop. § Load increased at Lockerbie. † All trains calling at Beattock banked in rear from there to Summit. ‖ No. 122 MS and 325 tons from Beattock. ‡ Piloted to Beattock by No. 124 MS. * Piloted to Beattock by No. 149 DN. DN Dunalastair IV class, non-superheated. DS Dunalastair IV class, superheated. MS Superheated McIntosh type. PS Superheated Pickersgill type.

miles) speed fell merely from 51 to 48½ m.p.h. On the mile of downhill from Ballathie to the Tay we reached 66 m.p.h., and there onwards speed ranged round about this figure most of the way to Forfar, with a minimum of 64 before and a maximum of 68 after Alyth Junction. So we passed Coupar Angus, 15·8 miles, in severely restricted down Farnell Road bank; Guthrie, 39·5 miles, was passed in 41 min. 20 sec., and Bridge of Dun, 47·9 miles, in 49 min. 10 sec. The 39·3 miles from Cargill to Dubton Junction (passed 2¾ min. after Bridge of Dun) had been covered in 37 min. 20 sec., including Forfar slack.

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L.M.S. (CALEDONIAN) RAILWAY—GLASGOW–CARLISLE.

Distance.	Train.	10 0 A.M.			1 30 P.M.			10 10 A.M.		Ex-Edinburgh.	
	Engine: 4–4–0 No.	Schedule.	§136 DN	§73 PS	Schedule.	135 MS*	134 MS*	Schedule.	957 X	926 DN‡	96 PS
	Load (axles)		34	52		58/46†	54/50†		46	46	54
	,, (tons tare)		243	367		402/329†	376/342†		298	322	—
	,, (tons full)		260	395		430/325†	400/360†		315	350	405
Miles.		min.	m. s.	m. s.	min.	m. s.	m. s.	min.	m. s.	m. s.	m. s.
0·0	Glasgow	0	0 00	0 00	0	0 00	0 00	0	0 00		
3·1	Rutherglen	6	5 50	5 45	6	5 55	5 40	6	5 55		
8·5	Uddingston	13	12 40	11 50	13	12 10	12 00	13	12 50		
				sigs.							
12·8	Motherwell	¶ 19	19 35	18 00	pass	pass	pass	¶19	19 25		
		20	20 00	19 35	19	17 40	17 45	21	21 00		
18·2	Law Junction	30	31 30	30 20	29	26 30	26 55	31	32 55		
23·6	Craigenhill Box	—	40 20	39 20	—	35 50	36 30	—	42 35		
28·8	Carstairs	pass	45 40	44 45	pass	sigs.	pass	pass			
		46	46 45	45 45	45	44 50	42 45	47	48 20		
32·3	Leggatfoot Box	—	54 30	53 40	—	51 10	48 00	—	52 40		
35·4	Symington	pass	pass	pass	53	55 50	53 00	pass	pass		
		56	58 30	58 00	59	60 45	58 45	57	56 35	‖ 0 00	†† 0 00
39·1	Lamington	—	62 45	62 35	—	67 15	64 40	—	60 40	3 50	6 04
44·5	Abington	—	68 55	69 00	—	73 20	70 45	—	66 55	9 40	12 38
49·7	Elvanfoot	—	76 10	76 20	—	80 10	77 55	—	74 10	15 55	19 42
52·6	Summit	pass	pass	pass	pass	pass	pass	pass	pass	19 45	pass
		80	80 35	81 10	82	84 45	82 25	80	78 45	21 05	24 23
62·6	Beattock	pass	pass	pass	pass	pass	pass	91	89 55	pass	pass
		91	90 20	91 25	93	94 45	92 45	93	92 10	32 15	35 40
67·8	Wamphray	—	95 05	96 40	—	99 55	98 00	—	99 20	37 15	40 38
76·5	Lockerbie	pass	pass	pass	pass	pass	pass	109	108 40	pass	pass
		106	104 15	106 10	107	109 20	106 40	111	110 25	46 20	49 06
79·6	Castlemilk Box	—	107 50	109 45	—	113 10 p.w.r.	110 15	—	116 25	49 50	52 37
85·6	Kirtlebridge	115	114 20	116 10	116	120 00	116 45	121	122 40	56 10	58 20

10 0 a.m. Train.

2 44 p.m. *ex*-Symington.

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93·7	Gretna	123	122 35	sigs. 128 45	124	128 40	124 35	131	130 50	63 50	65·59
100·3	Kingmoor Box	—	127 20	136 40	—	135 35	131 40	—	137 50	70 00	72 35
											sigs.
102·3	Carlisle	134	132 00	139 45	135	138 35	134 45	142	140 50	72 50	82 30
102·3	Net running times (min.) ..	133	130½	130¾	129	130	129	136	135¼	—	75¾

§ Piloted by Carstairs by small 4–4–0 No. 66. * Piloted to Symington by No. 772 (Dunalastair II superheated) and 902 (Dunalastair III) respectively. ¶ Conditional stop. ‖ Passing time : working allowance 21 min. to Summit and 74 min. to Carlisle. ‡ Piloted to Summit by No. 896 (Dunalastair III). DN Dunalastair III and IV, non-superheated. MS Superheated McIntosh type. † Reduced load from Symington. PS Superheated Pickersgill type. X Pickersgill 3-cyl. 4–6–0 type. †† Schedule as 1.30 p.m., Symington–Carlisle.

reached on the tempting descent to Fordoun. Minimum speed up the 1 in 285 past Laurencekirk was 54 m.p.h., and maximum past Kinnaber 65 m.p.h. ; so we passed these two points, respectively 30·6 and 38 miles from Aberdeen, in 41 min. and 48 min. 40 sec., and Bridge of Dun, 41·9 miles, in 52 min. 40 sec., over 3¼ min. early. The engine was then so severely eased up Farnell Road bank (3½ miles, mostly at 1 in 96–120) that we fell to 31 m.p.h., and dropped 2 min. on to Guthrie (50·3 miles, 64 min. 40 sec.), while Forfar, 57·3 miles, was reached in 73¼ min., instead of the 75 min. allowed. By smart station working at Forfar we got away at the public time of 4.40 p.m., instead of the working time of 4.43 p.m., and this ruined the run to Perth, as the driver took within 20 sec. of the full 37 min. available to secure a punctual arrival, instead of the strict working allowance of 34 min. for the 32·5 miles. Consequently the speed at no point exceeded 61½ m.p.h., and we took 14 min. 20 sec. to Alyth Junction, 12 miles, 29 min. 5 sec. to Coupar Angus, 26·7 miles, 28 min. 25 sec. to Stanley Junction, 25·3 miles, and 36 min. 40 sec. to Perth, even the alluring drop from Stanley into Perth being taken without steam.

But we did well from Perth southwards. After the removal of the postal portion, Pickersgill superheated 4–4–0 No. 76 came on to a greatly increased load of 52 axles (four eight-wheelers, including Pullman "diner," and six twelve-wheelers), weighing 348 tons empty and 365 tons full. On the first undulating and level 5 miles out of Perth we got up to 54 m.p.h. beyond Forgandenny ; the next 5¼ miles up, averaging between 1 in 400 and 1 in 500, barely brought us below 50, and then we tackled the 1 in 121 from Dunning steadily at 29 m.p.h., while the 1 in 100 beyond, with its steeper occasional pitches at 1 in 90 or so, did not bring us below 27 m.p.h. This was excellent work with such a load, as the 1 in 121–100 portion of this bank is 7 miles in length. In fact, it extends to beyond Gleneagles, and although the actual start there is on 1 in 200, there is half a mile at 1 in 100 still to tackle before the summit is topped. From Perth we passed Hilton Junction, 2 miles, in 5 min. 20 sec. ; Forgandenny, 3·9 miles, in 7 min. 40 sec. ; Forteviot, 6·8 miles, in 10 min. 55 sec. ; Dunning, 9·6 miles, in 14 min. 5 sec., and Auchterarder, 13·7 miles, in 20 min. 55 sec., reaching Gleneagles, 15·8 miles, in 25 min. 20 sec., the schedule being 25 min.

From Gleneagles we started without any banking assistance, attained 18 m.p.h. up the half-mile at 1 in 100, but then went very sluggishly down to Kinbuck, speed only rising to 60 m.p.h. below Blackford, and actually falling to 52½ on the succeeding slightly falling and level stretch to Kinbuck. Down Dunblane bank, too, we simply crawled, and so took 5 min. 59 sec. from the start to Blackford, 2·2 miles, 13 min. 50 sec. to Kinbuck, 9·6 miles, and 23 min. 5 sec. into Stirling, 17·2 miles, allowed 22 min. Here our load was

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further made up to 56 axles, or 400 tons gross, and this caused us to lose a minute on the 12 min. allowance to Larbert, 8·8 miles—a tight figure for so short a distance with a 400-ton train, especially as it includes a two-mile rise mostly at 1 in 118, on which our speed fell to 34½ m.p.h. But with a much reduced load of 290 tons we ran the 22·1 miles from Larbert to Glasgow in 30 min. 25 sec., instead of 33 min. allowed, climbing the 2 miles at 1 in 103 to Greenhill (3·6 miles, 7 min. 10 sec.) at a minimum of 33 m.p.h., and topping the ¾-mile at 1 in 98 and the 2 stop must be made if the load exceeds " = 12½ " (which means 34 axles, or about 260 tons or so), and the non-stop run over Summit is, therefore, but rarely made. On the first occasion, however, No. 136, fitted with Weir feed-water heater and pump, had a load of under 200 tons, and so took the famous bank unassisted. Quite a rapid exit was made from Carlisle, with a maximum of 64½ m.p.h. at Floriston, and minima of 44½ on the two long 1 in 200 ascents to Brackenhill Summit (Castlemilk Box); from Lockerbie onwards we made some un-

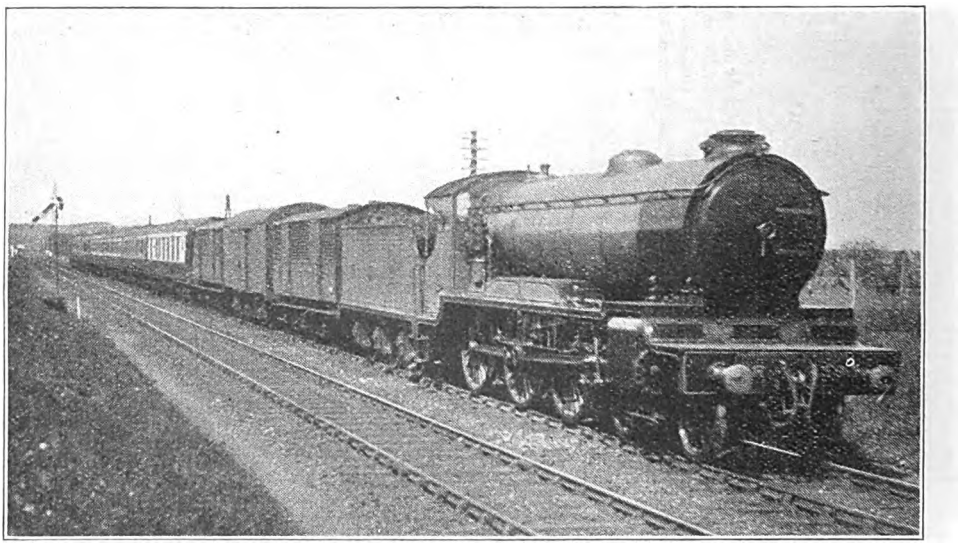

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Henry L. Salmon.*

12.30 p.m. Aberdeen–Glasgow and South Pullman Car Express near Perth. Caledonian three-cylinder 4–6–0 locomotive No. 959.

at 1 in 128 to Cumbernauld (9 miles, 14 min. 20 sec.) at the excellent figure of 42½ m.p.h.

Between Glasgow and Carlisle I have had a large number of runs, and although but few of them incorporate features calling for particular comment, I have tabulated the best examples in the annexed tables. In the north-bound direction the first two trips were made on the 10 a.m. from Euston to Glasgow, which is smartly timed as far as Carstairs, but could without difficulty be expedited by more than 5 min. between Carstairs and Glasgow. Nominally this is the only train scheduled to take Beattock bank without pilot or banking assistance, but the Beattock usually fast running, with a top speed of 69 m.p.h. at Nethercleugh, and 65 still maintained at Wamphray. We passed Summit at 28 m.p.h., over 5¼ min. early, but by slack running thereafter and various signal checks, including a stop, took the exact overall time to Glasgow. On the second trip the load was considerably heavier, and the start 5¾ min. late, which we easily recovered from Symington onwards. At Floriston we were doing 60 m.p.h., and on the 1 in 200 ascents 41 and 43 m.p.h. respectively, while once again we ran exceedingly well from Lockerbie to Beattock, with a sustained maximum of 65 m.p.h. Banked by a 0–4–4 tank, we attained 37½ m.p.h. at

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Greskine, and fell to 33 at Summit; speed ranged from 62½ to 66 m.p.h. from Elvanfoot to Lamington, 47½ at Symington, 64½ at Thankerton, 53½ at Leggatfoot, and 60 before Carstairs, after which there was, as usual, "nothing to report."

Some of the Liverpool and Manchester trains, with their numerous stops and no inconsiderable loads, are, in my judgment, harder to work than the London trains, and the 3.30 p.m. out of Carlisle is a case in point. The two runs tabulated on this train, with identical loads, were very similar in character, the engine in the first case being one of the Dunalastair IV 4–4–0's now superheated, and that in the second case being one of the batch built by Mr. McIntosh with superheaters. Speeds were 64½ and 62 m.p.h. at Floriston, 45½ and 45 m.p.h. minimum up the Kirkpatrick 1 in 200 (7½ miles), and 47 and 50 up the 5¼ miles past Ecclefechan, No. 46 catching up slightly on No. 140 beyond Kirtlebridge. Smart runs were made between Lockerbie and Beattock, both engines improving on time; maxima beyond Wamphray were 64½ and 61 m.p.h. For banking assistance large 4–6–2 tanks were supplied, but the ascent of the bank on the first occasion was distinctly poor, speed ranging from 31½ m.p.h. at Greskine to 27 at Summit, whereas on the second the corresponding figures were 34 and 31½ m.p.h., the latter steadily for over 4 miles. The usual leisurely speeds were run from Summit down to Lamington, time being lost to Symington, as is invariably the case; we did not exceed 68 and 65 m.p.h. at Lamington, though the Thankerton "dip" brought us up to 69 and 70½ m.p.h., and time was gained from Beattock to Carstairs to the extent of 1 and 2¼ min. on the respective journeys. A late start from Carlisle of 5¼ min. was more than made up to Glasgow on the first run, but a prolonged signal stop at Carluke prevented us from actually recouping 4 min. on the second, as we really did by net reckoning.

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*C. J. L. Romanes.*

Glasgow–Inverness train near Dalwhinnie. Highland 4–6–0 locomotive No. 57, "Clan Cameron."

On the 12.51 p.m. No. 116, of the superheated Pickersgill 4–4–0 type, had a train sufficiently substantial to be piloted from Carlisle to Beattock. The two engines did very well, touching 64½ m.p.h. at Floriston, after a rapid start out of Carlisle; the minima on the 1 in 200 ascents were then 45 and 48½ m.p.h., with an intervening maximum of 64½ at Kirtlebridge. From Lockerbie to Beattock, with an increased load of 430 tons, a brilliant run was made, the 13·9 miles being covered in 16 min. 20 sec. start-to-

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stop, with a speed of 62½ m.p.h. from Nethercleugh to Dinwoodie, and a maximum of 67 at the crossing of the Annan beyond Wamphray, while the 1 in 202 from there up to Beattock station (3⅜ miles in length, with an additional ½-mile at 1 in 174) was negotiated without speed falling below 52 m.p.h. before steam was shut off for the stop. At Beattock the pilot came off, and 4–6–2 tank No. 951 came on in rear; we got up to 29½ m.p.h. at Greskine, but fell to 27 at Summit. But the running after the Elvanfoot p.w.r. check was very poor; we did not exceed 64½ table, although not greatly improving on the 18 min. 10 sec. of No. 136 with 280 tons. Speeds were 35½ m.p.h. at Auchencastle and 34 from Greskine to Summit, while down to Lamington 61 m.p.h. was not exceeded. It will be noticed, as bearing upon remarks made earlier in the present article, that time was lost on every run in this table on the allowance of 17 min. for 17·2 almost exclusively downhill miles from Summit to Symington.

We now come to the table of the up journeys. The timing of the 10 a.m. out of Glasgow is easy enough, except when

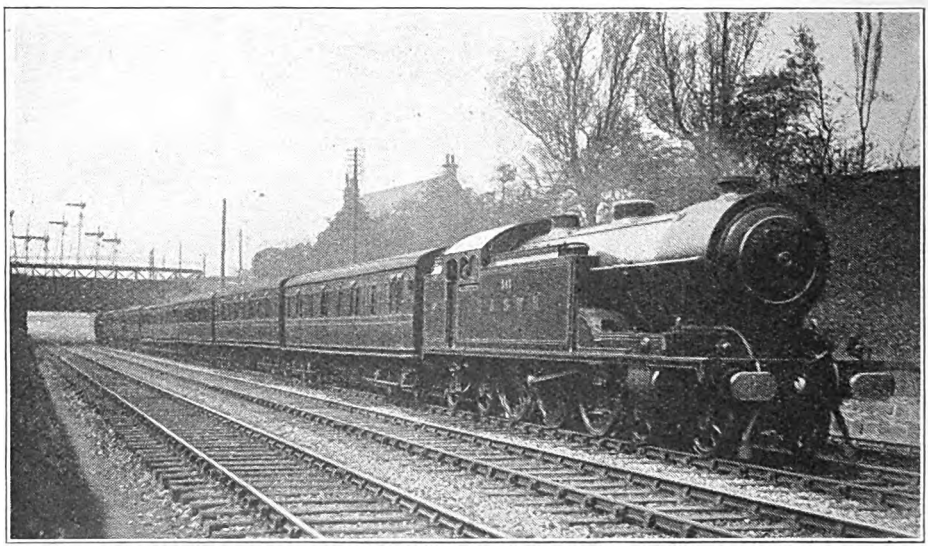

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Henry L. Salmon.*

Stranraer-Glasgow Express near Ibrox. Glasgow & South Western 4–6–4 tank engine No. 541.

m.p.h. at Lamington, and of the loss of 4¼ min. from Beattock to Symington not more than 2 min. at most could be put down to the slack.

The last of the runs reaches me from a correspondent; despite an even heavier train a remarkable time was made to Lockerbie, with maxima of 64 m.p.h. at Floriston and 61½ at Kirtlebridge, and a minimum of 46½ on the first 1 in 200. From Lockerbie to Beattock, also, the time of 16 min. 40 sec. is only 20 sec. in advance of mine; the speed at Wamphray was 64 m.p.h. The subsequent run north of Beattock was made on another occasion, and for the load concerned—325 tons—was the best of all the ascents in the the summer loads are exceptionally heavy. Nos. 66 and 136 laid themselves out in a very modest manner to Carstairs with their light train, but after Carstairs, where the stop was actually made about half a mile north of the station, No. 136 did some respectable work. Speed at Lamington was 62½ m.p.h., and the minimum at Summit, after 2¼ miles at 1 in 99, 33; while we descended the bank at Beattock quite gaily at 66 to 74 m.p.h. all the way. Very easy going after that sufficed for time-keeping; indeed, the time of 73½ min. from Symington to Carlisle represented a gain of 4½ min. on schedule. The two engines on the second run made a brilliant start out of Glasgow, with speeds of 55

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m.p.h. at Rutherglen and 64½ at Uddingston, while we were still doing 47½, after 3¾ miles rising at 1 in 115–135, when steam was shut off for a signal check short of Motherwell. Then we attained 36 m.p.h. from Motherwell start up an inclination chiefly at 1 in 116–137 to Shieldmuir, and did not fall below 34 on the 3¼ miles at 1 in 102 to Law Junction, so making quite good times with this heavy train to Carstairs, where the stop was effected in the same place as before. After that the performance of No. 73 was fair to Lockerbie, with speeds of 61 m.p.h. at Lamington, two engines passed Lamington at 60 m.p.h., Abington at 49½ and 48½, Crawford at 48 and 42 m.p.h., the top of the steeper rise before Elvanfoot at 44½ and 40, and the last Clyde bridge at 49½ and 49 m.p.h., while the summit was breasted on both runs at 32 m.p.h. Speeds up to 75 m.p.h. were attained on the bank, but with many slacks, on the first run, and both trains passed Beattock in precisely the allowed time from Symington. But from Beattock No. 135 dropped time to Gretna; apart from the Ecclefechan p.w.r. check, and on the net throughout running time there was

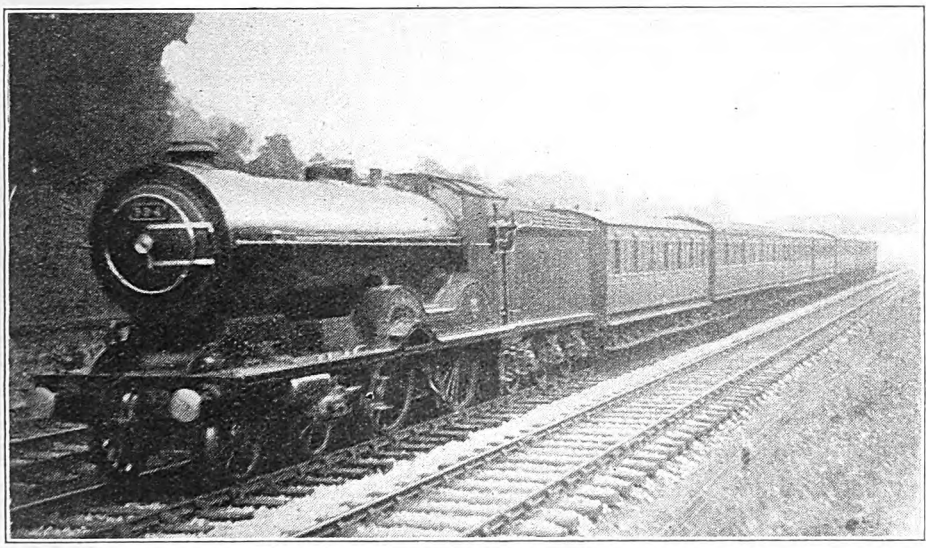

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Henry L. Salmon.*

12.30 p.m. Glasgow–Stranraer Express near Ibrox. Glasgow & South Western rebuilt four-cylinder 4–4–0 locomotive No. 394, "Lord Glenarthur."

28 at Summit, and a maximum of 71½ on the bank, but we fell to 46½ at Castlemilk, and the signal stop at Quintinshill of 85 sec. prevented a punctual arrival.

The 1.30 p.m. London express, with its heavy Liverpool and Manchester addendum from Glasgow to Symington, and then the Edinburgh portion, for which the latter is exchanged at Symington, is a decidedly more difficult proposition. The two runs from Glasgow out to Symington, double-headed, of course, were both excellent performances, although adverse signals on the first run accounted for a loss of nearly 4 min. After leaving Symington, where both the pilots were dropped, but still with substantial loads of 325 and 360 tons, the a loss of a minute. No. 134, however, did better work with the heavier train, running at from 65 to 61 m.p.h. from Wamphray to Nethercleugh, falling to 47 at Castlemilk, and touching 70½ at Kirtlebridge; but, in accordance with invariable practice, the speed down the tempting 1 in 200 past Gretna did not exceed 67 m.p.h. We kept exact schedule time to the second from Symington to Carlisle.

The big three-cylinder 4–6–0 made a very decorous run on the 10.10 a.m. train. We only reached 50 m.p.h. at Rutherglen and 56½ at Uddingston, with a minimum of 42½ at Newton, and 39 before shutting off for Motherwell. No banking assistance was taken from Motherwell start;

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we attained 33 m.p.h. by Shieldmuir, and passed Law Junction at a shade over 30, while speed was 56½ beyond Cleghorn when we slacked to 50 through Carstairs. Regaining 53½ beyond Strawfrank, we went up to Leggatfoot (2 miles at 1 in 150) at a minimum of 43; we then touched 64½ at Lamington, and the minimum at Summit was 30½, precedent to a very cautious descent of the bank. On the short run from Beattock to Lockerbie the maximum speed, at the Annan, was 64 m.p.h. The final run from Lockerbie to Carlisle was 40 sec., and Symington, 33·8 miles, in 46¾ min., after which the times appear in the table. Speed at Lamington was 64½ m.p.h., at Abington 53, before Elvanfoot 45, and after 53, while the minimum on the 1 in 99 to Summit before steam was shut off for the stop was 47½ m.p.h., this being by far the fastest climb from Symington in the table. After 80 sec. stop, No. 926 did excellently by running the 49·7 miles from Summit to Carlisle in 51¾ min., start-to-stop, with maxima of 75 m.p.h. on the bank and 69 at Gretna, and a

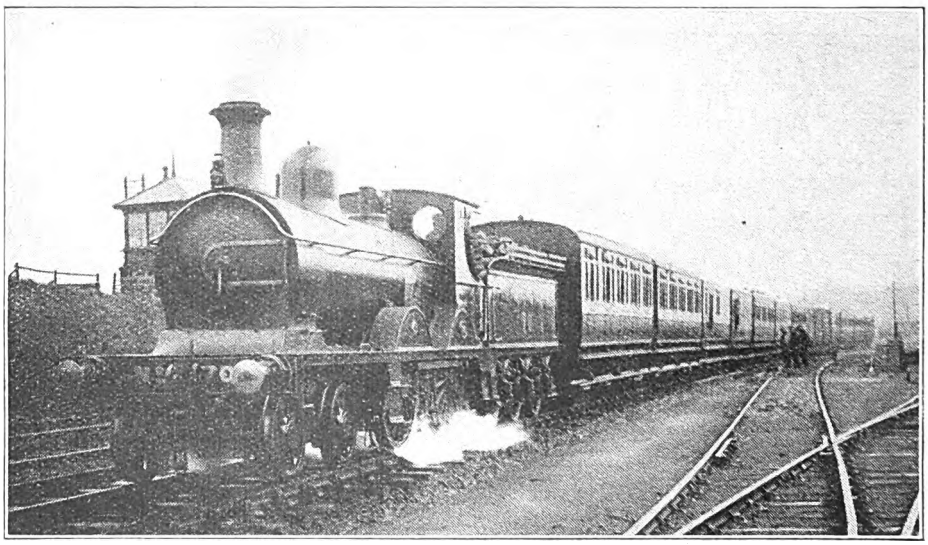

Photo.] LONDON AND NORTH EASTERN RAILWAY. [*Henry L. Salmon.*

Aberdeen–Macduff train passing Kittybrewster. Great North of Scotland 4-4-0 locomotive No. 70, repainted and lettered in new style.

under very easy steam, and requires no comment.

Both the two last runs in this direction reach me from correspondents. The first was on the non-stop 10 a.m. from Edinburgh to Carlisle, when a pilot was taken throughout to Summit on account of exceptional loading. The profile from Edinburgh to Cobbinshaw Summit was given in the issue of last March. Slateford, 2·2 miles, was passed in 4 min. 35 sec., Currie Hill, 5·5 miles, in 9¾ min. (with a speed of 39 m.p.h. at the top of the 1 in 143), Midcalder, 10·1 miles, in 16¾ min., and Cobbinshaw, 18·5 miles, in 29 min. 35 sec., speed being 36 m.p.h. at the top of 5½ miles at 1 in 100. Strawfrank Junction, 27·4 miles, was passed in 38 min. minimum of 47½ at Castlemilk. Total time from Edinburgh to Carlisle was 119 min. 35 sec.

On the last trip the work on the 1.30 p.m. out of Edinburgh to Cobbinshaw Summit was some of the fastest I have ever known on this route. No. 772 (non-superheated Dunalastair II) and No. 96 passed Slateford with 320 tons in 4 min. 2 sec., Currie Hill in 8 min. 37 sec., Midcalder in 14 min. 24 sec., Harburn, 15·4 miles, in 21 min. 30 sec., and stopped half a mile short of Cobbinshaw station, about 18 miles, in 25 min. 24 sec., the pilot being detached here. No. 96 then ran the remaining 15·8 rather tortuous miles to Symington in 20 min. 26 sec., the total time here out of Edinburgh, including 1 min. 54 sec. standing,

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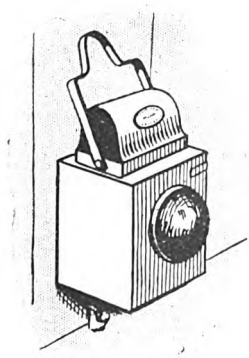
being 47 min. 44 sec., or ¾ min. over schedule. From Symington No. 96 worked (as is usual) on the Aberdeen, Liverpool and Manchester train, and did well to maintain net time with so heavy a load as 405 tons, although the pace down Beattock bank was distinctly over-cautious. Net times shown below these two Caledonian tables, by the way, are simply the overall times, less time actually standing at stations, and time lost by signal and p.w.r. delays. The down runs show the more time in hand of the two, as the down timings are generally a good deal easier than the up, and the chief difficulty of the down route is concentrated in the one 10-mile bank, where banking assistance is always available.

As regards the Glasgow and South-Western section of the L.M.S., I am indebted to a Kilmarnock correspondent for details of two fine runs on the 5.10 p.m. 50-minute express from Glasgow to Ayr. On both occasions the load was one of 32 axles, weighing 212 tons empty and 230 tons full, while the engines were one of the large 4–6–4 tanks—No. 541—on the first occasion, and Mr. Whitelegg's interesting superheated rebuild of the four-cylinder 4–4–0—No. 394, *Lord Glenarthur*—on the second. The 7·7 miles out to Paisley were run with the usual caution in 11 min. and 11 min. 10 sec., and Elderslie, 9·7 miles, was passed in 13 min. 33 and 50 sec.; Howwood, 13·8 miles, in 18 min. 28 and 50 sec., and Lochside, 16·5 miles, in 21 min. 28 and 55 sec., speed having now risen to 60 m.p.h. on both occasions. From here the 21·5 miles on to Prestwick were run in precisely 21 min. and in 21 min. 10 sec., No. 394 suffering the effects of a very heavy west wind off the sea. No. 541 touched 68 m.p.h. at Glengarnock and near Kilwinning, and 69 at Bogside, while No. 394 reached 70 m.p.h. at the latter place; speed on both runs was slightly moderated approaching Dalry, Kilwinning and Irvine, and No. 541 had in addition very slight signal checks at Gailes and Barassie. Passing times were:—23 min. 35 sec. and 24 min. 5 sec. to Beith, 18·6 miles; 28 min. 3 and 55 sec. to Dalry, 23·3 miles; 31 min. 18 sec. and 32 min. 10 sec. to Kilwinning, 26·8 miles; 34 min. 18 sec. and 35 min. 10 sec. to Irvine, 30·2 miles; 37 min. 51 sec. and 38 min. 35 sec. to Barassie, 33·8 miles; 42 min. 28 sec. and 43 min. 5 sec. to Prestwick, 38·3 miles, and 46 min. 48 sec. and 47 min. 30 sec. to Ayr stop, 41·3 miles. Net time of the "Baltic" tank, which was driven by R. Duncan, was 46½ min.; the 4–4–0 was driven by J. Robson, both of Ayr shed.

It would be useless to attempt at this late stage to enter upon running over the various sections of the London and North Eastern line in Scotland, but I have recently obtained some notable records over the North British section, as well as a return journey of no small interest over the Great North of Scotland section. I must, however, leave these for description in a later contribution.



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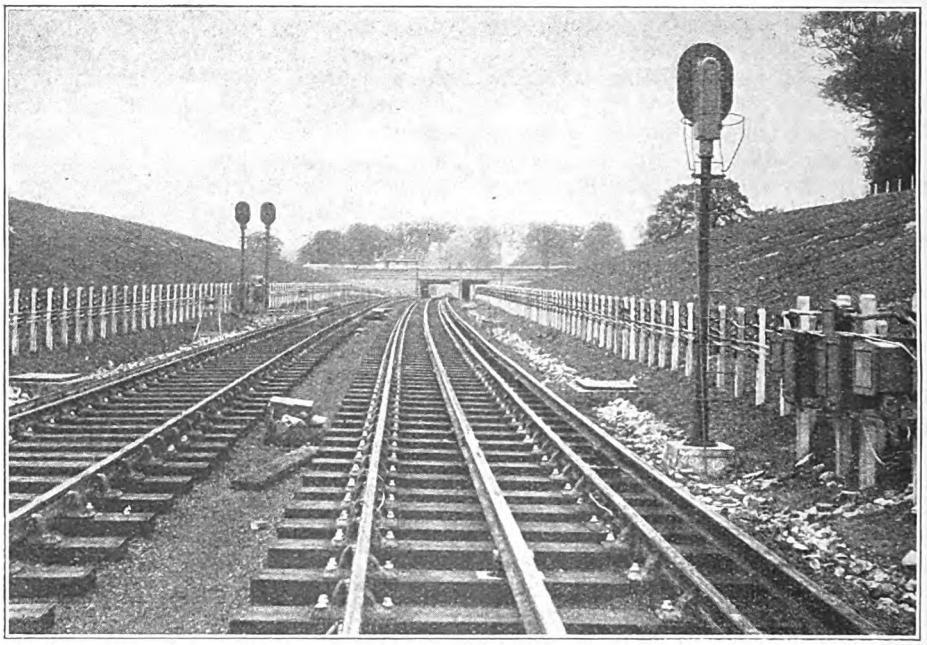

CUTTING NEAR HENDON AND COLOUR LIGHT SIGNALS.

The Golders Green-Hendon Extension of the London Electric Railway.

ON Monday, November 19, in the presence of a large party, including directors of the associated "Underground" companies, chief officers, representatives of Government departments, and of the Middlesex County and Hendon Urban District Councils, and others, the Right Hon. Sir Philip Lloyd-Greame, K.B.E., M.C., M.P., President of the Board of Trade, formally inaugurated public traffic on the extension of the London Electric Railway from Golders Green to Hendon by switching current to the new section.

It will be remembered that on June 12, 1922, as recorded at the time in these pages, Sir Philip Lloyd-Greame, as President of the Board of Trade and M.P. for Hendon, performed the ceremony of "cutting the first sod" at a point near Woodstock Avenue, Golders Green. The first stage of the extension line from Golders Green has thus been constructed in the relatively short time of 17 months. Work is also well in hand on the further extension from Hendon to Edgware, included in the complete scheme, and it is anticipated that this will be opened for public traffic during next spring. In fact, through communication has already been completed from the north to the south end of the Colindale tunnel (1,160 yards in length) just beyond Hendon (Central) station, this being one of the heaviest undertakings on the Hendon-Edgware section. Hendon (Central) station is, therefore, a terminus temporarily only. The Hendon Extension is part of the £6,000,000 scheme for the development of tube railways authorised last year, and has been rendered practicable largely because of the assistance rendered in the form of Government credit under the Trades Facilities Act. A primary purpose was, of course, that of easing the unemployment situation, an object which has been well fulfilled, in that employment has been created by this extension alone

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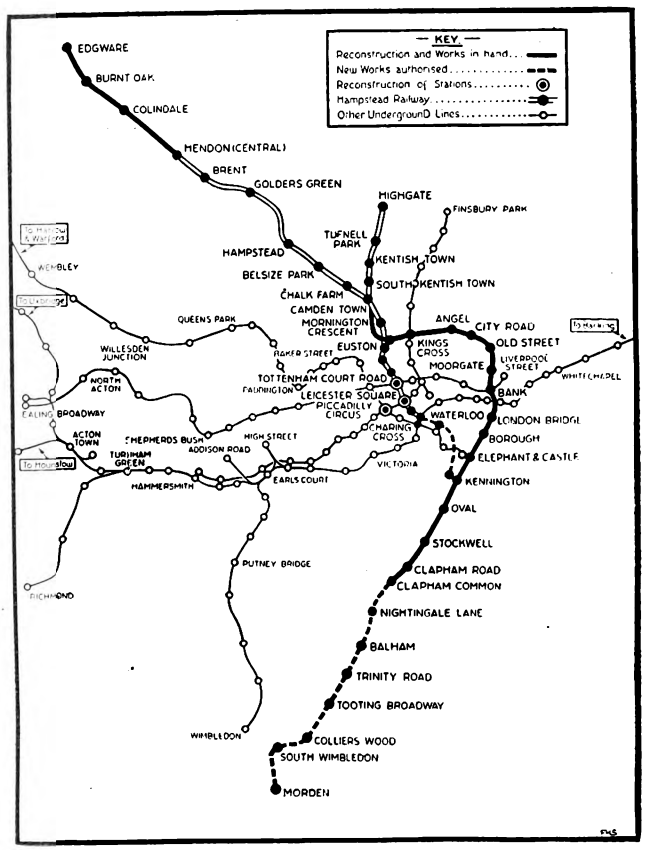
for many thousands of men for the greater part of two years, and which still serves this purpose in so far as the Hendon-Edgware section is concerned.

It has been necessary to make considerable extensions at Golders Green station, where three platform lines with five platform faces, together with additional siding and car shed equipment, are now available. Immediately beyond Golders Green station, Finchley Road is crossed by a large girder bridge, having an 88-ft. span. Other large bridges are those over Golders Green Road (92-ft. span), and Elmcroft Crescent (129½-ft. span). Altogether there are 12 steel girder and brick bridges, while about 5,000 ft. of viaduct have had to be erected, the principal being that at Brent, 300 ft. long and 34 ft. high. The principal embankments are those at the "Riding" (1,870 cubic yards), and between Highfield Avenue and Brent (32,228 cubic yards). The principal cuttings are those between "Ridgeway" and Woodstock Avenue (11,575 cubic yards), and leading to Hendon (Central) station (70,000 cubic yards), while between Woodstock Avenue and Elmcroft Crescent 2,148 cubic yards of filling have been required. Altogether about 8,000,000 bricks have been used in the construction of viaducts, bridges, retaining walls, &c., and some 165,000 tons of earth excavated with the aid of steam shovels, having a capacity of 750 tons a day, and transported to other portions of the line as required; 35,000 tons of concrete have been used for foundations and other purposes. Associated works included the raising of Woodstock Avenue 7 ft. to permit the line to pass beneath on the level, while Queen's Road, Hendon, has been raised 4 ft. to enable the line to pass beneath it.

As the new line was intended for heavy traffic from the very first, it has been substantially built in every respect. Both of the new stations are of island type, that at Brent being on viaduct, with booking hall at street level below, and that at Hendon (Central) being in cutting, with station buildings at one side with footbridge approach to the platform. In each case station buildings are of notable character, with lofty and spacious booking halls. Entrance is effected through Portland stone porticoes formed of coupled Doric columns, the architecture being Georgian in style and the roofs being covered with Italian tiles and having wide projecting eaves. Red and purple sand-faced bricks lend a touch of colour, while the neat cabinet work of the passimeter installations combines to convey a most pleasing impression. The area of the booking hall at Brent is 2,500 sq. ft., and that at Hendon (Central) 3,250 sq. ft., including the vestibule. Brent station is approached by a macadam forecourt,



MAP SHOWING NEW LINE AND WORKS UNDER CONSTRUCTION AND AUTHORISED.

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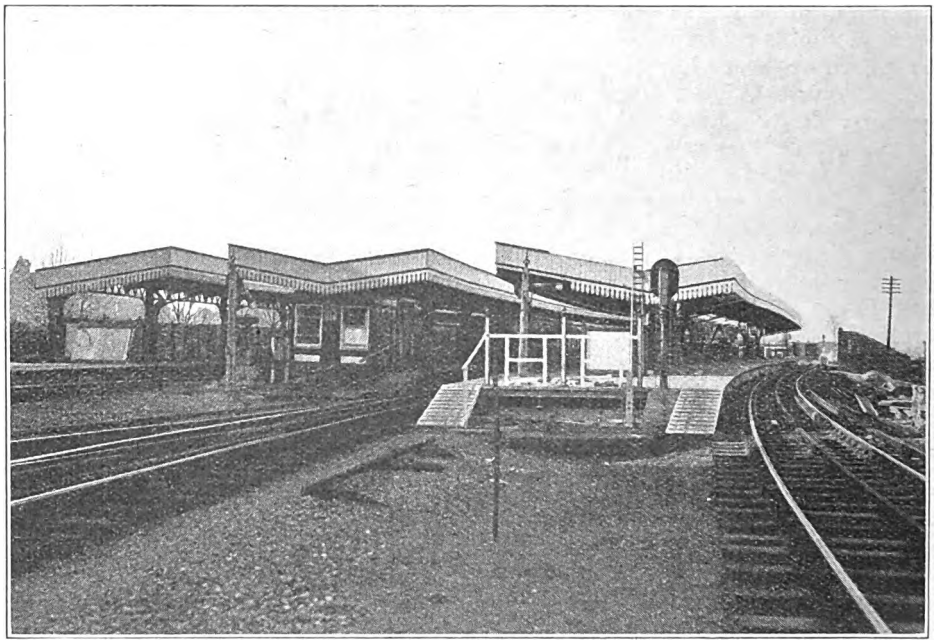
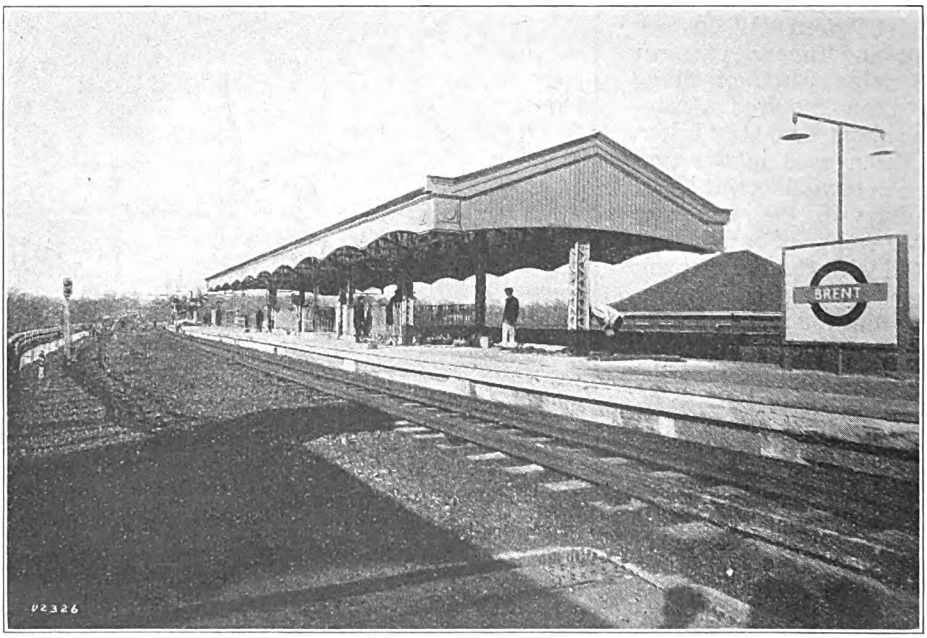


GOLDERS GREEN STATION AFTER ALTERATIONS.



BRENT STATION.

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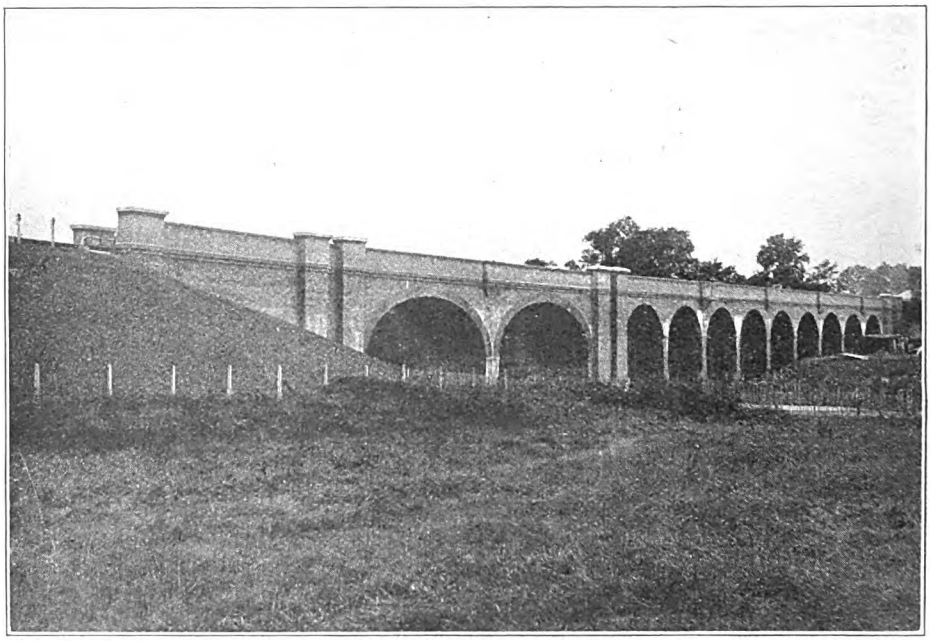
having an area of 5,800 sq. ft. Hendon (Central) is situated at a point where four roads converge, forming a circus 240 ft. in diameter. The whole of this area, which has already become known as "the Piccadilly Circus of North-West London," has been raised 14 ft. Platforms at both stations are 350 ft. in length.

Signalling is all-electric, utilising two-indication colour light signals. All the material was supplied by the Westinghouse Brake & Saxby Signal Co. Ltd., but was installed by the "Underground" signal staff under Mr. W. S. Every. Elevated signal cabins are provided at both Brent and Hendon (Central) stations, but that at the former is not at present in use. It has been erected with a view to the provision of passing loops in each direction outside the respective platform lines, for which sufficient width has been allowed in constructing the viaduct. It is anticipated that when the Edgware Extension is completed and traffic has developed sufficiently it may be necessary to run fast trains, in which case the loops will enable a non-stopping train to pass another which is standing at the platform. At Hendon, which is, for the present, a terminus, the signal cabin is, of course, required, though it is adapted for switching out at times when it is not necessary to use the crossover. In each case illuminated diagrams are, or will be, provided. A complete equipment of signals has been installed to permit of a train service at close headway, and to operate automatically, except at places where, and at times when, point operation may be required. Fog colour light repeaters have also been installed.

In view of the extension considerable structural alterations have had to be made at Golders Green. A re-arrangement of the tracks also permits of trains being reversed at Golders Green or continued to Hendon as may be required. It will be possible to operate 56 trains per hour in both directions as against 34 before the improvements were effected. Sidings have also been constructed to enable cars to be coupled up or uncoupled with or from trains standing in the centre platform without causing any delay to the services on adjacent lines. These improvements alone will cost £38,000. The cost of the new line to Hendon, including station buildings and equipment, will be over £500,000. The total cost of the extension from Golders Green to Edgware, the new



BRENT VIADUCT.

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Two Notable Retirements.

UNDER date of December 1, the first official intimation of the retirement of Sir William Forbes, late General Manager of the London, Brighton and South Coast Railway, was made in a Special Traffic Notice for the "Brighton" Section of the Southern Railway, in the form of a message to the Staff, under Sir William Forbes' signature, in the following terms :—

SIR WILLIAM FORBES,
General Manager,
London, Brighton & South Coast Railway, 1899–1923.

"On retiring from the position of General Manager I wish to express my very sincere thanks to the Staff of the Brighton Railway for the efficient, loyal and intelligent assistance they have given me during the whole period of my management.

"It has made my official career an exceedingly happy one, and my task much easier to accomplish.

"To those who remain in the service of the Southern Railway I wish every success and prosperity.

"To those who follow me into retirement—long life, health and happiness to enjoy their well-earned rest.

(Signed) WILLIAM FORBES."

Sir William Forbes was born in Dublin in 1856. His father was then General Manager of the Midland Great Western Railway of Ireland. After an education at Dulwich College and on the Continent, where he gained proficiency in French and German, William Forbes, in 1873, started upon his professional career under his uncle, the late Mr. James Staats Forbes, who was then General Manager of the London, Chatham and Dover Railway, in the Goods Department. Subsequently he went into the Accountant's office and was, for a time, travelling auditor.

In 1889 he was appointed Continental Manager of the London, Chatham and Dover Railway, and here, naturally, his French and German education was of great advantage. All the arrangements for the 1889 Paris Exhibition traffic of the London, Chatham and Dover Railway were carried out by him with great success. One of the features of the arrangements was the "Club Train" to Dover, which the London, Chatham and Dover Railway ran in co-operation with the Sleeping Car Company. He was shortly afterwards appointed Traffic Manager of the London, Chatham and Dover Railway, and remained in that position until the working arrangements with the South Eastern Railway in 1898 came into operation, when he then became Assistant General Manager of the South Eastern and Chatham Railway. The work he had done specially qualified him for the post of General Manager of the Brighton Railway, which in 1899 became vacant, when the late Mr. J. F. S. Gooday left that

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A "Vibrating Light" Fog-Repeating Signal.

APART from special methods such as those covered by cab-signalling and automatic train control installations, whereby signals are repeated in the engine cab or the brakes are automatically applied as a train approaches an adverse "distant" or stop signal, the best means of providing for fog conditions is that adopted on the Metropolitan and "Underground" lines in London, the electric fog-repeater. This consists of a colour-light signal placed in advance of the signal it "repeats," and so positioned that a driver or motorman cannot fail to observe its glow of yellow or green light as he passes it, even should he be unable to see it far away. He then has ample time to bring his train to a stand at the signal proper, should it be against him. These signals are, of course, switched in only when fog or mist is about, but in practice they have enabled the lines in question to do away almost, if not quite, entirely with fog signalmen, while the fact that they can be switched in or out by the local signalman obviates any difficulty from delay in calling out fog signalmen. In fact, each signalman can switch the repeaters under his control more or less at his discretion, without reference to whether atmospheric conditions are the same a mile or so away.

But while such signals represent a relatively simple solution of the problem on electric lines, or where an electric supply is available, they have yet to be tested fully on standard railways, and it is to meet such conditions that The Gas Accumulator Company (United Kingdom) Ltd., of 3, Clement's Inn, London, W.C.2, and Beacon Works, Brentford, has applied its well-known dissolved acetylene automatically flashing or vibrating light to the conditions of a fog-repeater. This firm has for many years occupied a leading position in regard to lighthouse and marine lighting, for which its acetylene flashing lights are widely used all over the world. Moreover, about 1910, extensive experiments were made with "Aga" lights as applied to various types of railway signals for which distinctiveness was sought. In various parts of the Continent, in fact, large numbers of "distant" signals have these "flashing" lights, and the Furness section of the London Midland and Scottish Railway has had, for many years, a number of such signals in use. Consequently, though the "Aga" flashing "distant" has not been further developed here, the apparatus is one of a thoroughly-tried-out character, and there is no question of its reliability, once its suitability for introduction under given conditions is accepted. Indeed, there are hundreds, if not thousands, of marine lights where these installations are left unattended for twelve months on end, which are recharged only once or twice a year, and which give their intermittent flashes with chronological exactitude without variation or failure for long periods.

Hence, in suggesting that this system may provide a means of providing fog-repeaters on standard railways, particularly where no electric light supply is available, or, if available, its reliability may not be above question, the dependability and efficiency of the apparatus can fairly be taken more or less for granted. There is little question, too, as to the cost of installation and equipment, while maintenance should be quite a small matter.

Briefly, the "Aga" system includes a reservoir in which acetylene dissolved in acetone (a method entirely safe and free from any risks of explosion) is stored under pressure, sufficient quantities for lengthy use being contained in small space, and a mechanism, actuated by the acetylene itself, whereby, from a permanently burning pilot light, the main jet is automatically lighted and extinguished intermittently. Actually, the light is shown only for a fraction of a second, the dark period being relatively longer, so that very small quantities of gas are used. The fact that light impressions take time to fade away give the effect, however, of considerably longer illuminating periods, while the brightness of the acetylene light (which penetrates fog very efficiently) and

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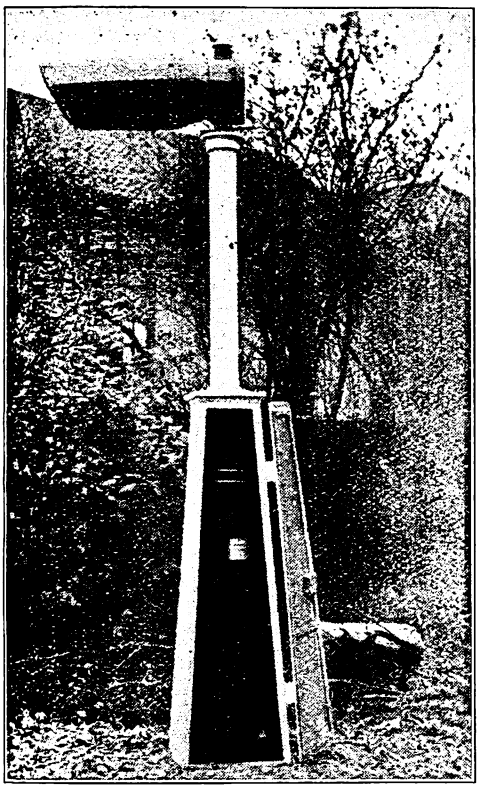

"AGA" "VIBRATING LIGHT" FOG-REPEATER.

the intermittence of illumination, cause very distinctive results to be obtained with very small gas expenditure.

As applied for railway purposes, therefore, the only points to be settled are those of candle-power to be adopted, number of flashes or vibrations per minute, periods between recharging of reservoirs, and the means of control to suit railway requirements. A candle-power of 4,000 is suggested as suitable for fog-repeater application, this providing considerable fog penetrating power, even when reduced by a yellow (or orange) or green lens or spectacle. Two hundred vibrations per minute give a vibrating rate which is neither too rapid for distinctiveness nor sufficiently slow to permit even the most casual and indefinite view failing to include at least one illumination. As regards control, a simple electric mechanism only is required, first, to switch on or off (the pilot would be left burning continuously), and secondly to change the yellow (or orange) and green spectacles according to the indication of the signal repeated. This mechanism can also include provision for a repeater in the signal cabin in the case of a signal not in the direct view of signalmen or some way away from the signal cabin.

So far as the period of service is concerned, this would usually be arranged for three or six months' service. Thus, using the firm's standard A25 container, supposing the unit is placed ready for service on September 30, before the winter season commences, and the pilot then lighted, the light may be brought into immediate operation by the turning of a switch in the signal cabin, and the accumulator is of sufficient capacity to allow of the light remaining in full luminous service during fogs for a period of 30 days of 24 hours each, before January 1 following. Should there happen to be only 10 or 15 days of fog during this period of three months, the accumulator would not be discharged by the latter date, but in any case it should be inspected then and the pressure taken. If it is standing at, say, three atmospheres, it would be safer to replace it by one fully charged, allowance being made for gas returned in the partly discharged accumulator. If it were desired to extend the unattended period from say September 1 to May 1, an A40 or A50 accumulator could be used, these having sufficient capacity to maintain the pilot light during the whole period, allowing for the equivalent of 33 days (of 24 hours each) fog in the period.

A photograph is reproduced showing one form in which the fog-repeater can be installed, though obviously, the actual construction can be made to agree with any preferred design. The base contains the container or "accumulator," of the A25 type, providing for the equivalent of 30 days' fog service in three months. (The larger size would require a larger cabinet). Above is a suitable support for the light and its mechanism, a hood being preferably fitted, though this is not absolutely necessary. A suitable control scheme is illustrated diagrammatically. Flashing is controlled, of course, entirely automatically, the value of the vibrating as compared with a steady light being, first, its distinctiveness and unmistakableness, and secondly, its economy in gas consumption. The colour change is operated by a simple mechanism. Both the vibrating and the colour changing mechanisms are controlled by simple electro-magnetic valves caused

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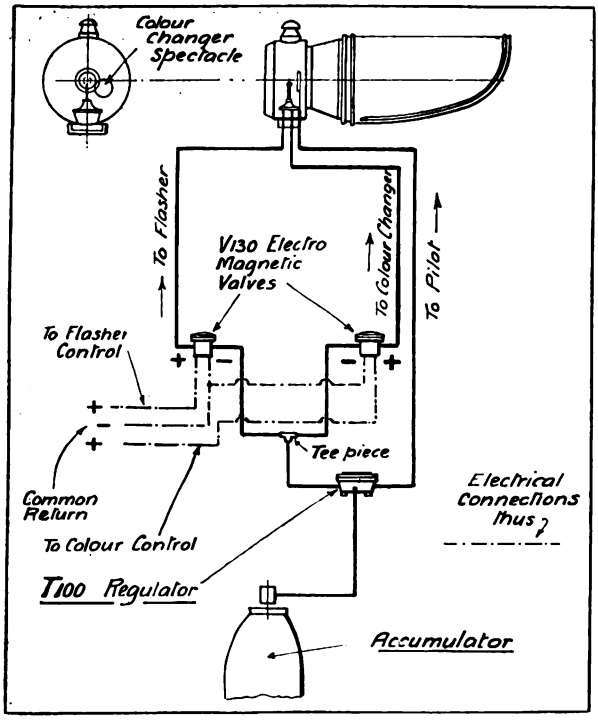


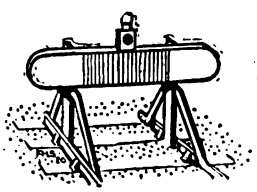
DIAGRAM OF CONNECTIONS FOR CONTROL AND OPERATION OF "AGA" "VIBRATING LIGHT" FOG-REPEATER.

to operate, one from the cabin switch which brings the repeater into or out of use, and the other from the signal which is repeated.

In matters of this kind special importance is necessarily attached to questions of cost, maintenance and inspection. As far as can be gathered, cost should not much exceed £25 to £30 for a complete equipment, apart from appliances in the signal cabin and for signal control, and excluding the cost of the accumulator, which would usually remain the property of The Gas Accumulator Company, as is general in cases where gases stored in high-pressure receptacles are concerned. Only exceptionally should it be necessary for any installation to require attention during its period of operation, so that inspection by the ordinary linemen (mainly on account of the electric control connections) or other staff at intervals would suffice. In the event of a failure, a spare burner or valve can be easily substituted, or should the gas supply be in question the simplest course would usually be to substitute a reserve accumulator, and return the one taken out for investigation. It is estimated that the cost of gas, allowing for an ordinary average of fog use, would be about 30-45 shillings per annum, according to the proportion of fog use.

On the basis of personal examination of a trial installation, there can be little doubt that this fog-repeater would satisfactorily serve its purpose. The acetylene light has been proved to penetrate fog well, while the vibrating character of the light tends to distinctiveness, thus avoiding any uncertainty either as to location or the purpose of the light once its illuminating effect, if not its light power, has come into view, however dimly. The installation differs, too, from electricity supply equipments, in that each unit is self-contained and self-operated, except for control purposes, in which respect the situation is substantially the same as for electric repeaters, over which, however, it possesses the considerable advantage of being independent of any extraneous source of illumination.

We understand that trials on at least one leading railway are to be made this winter, and we hope to be able to refer to the results of experience thus gained in due course.



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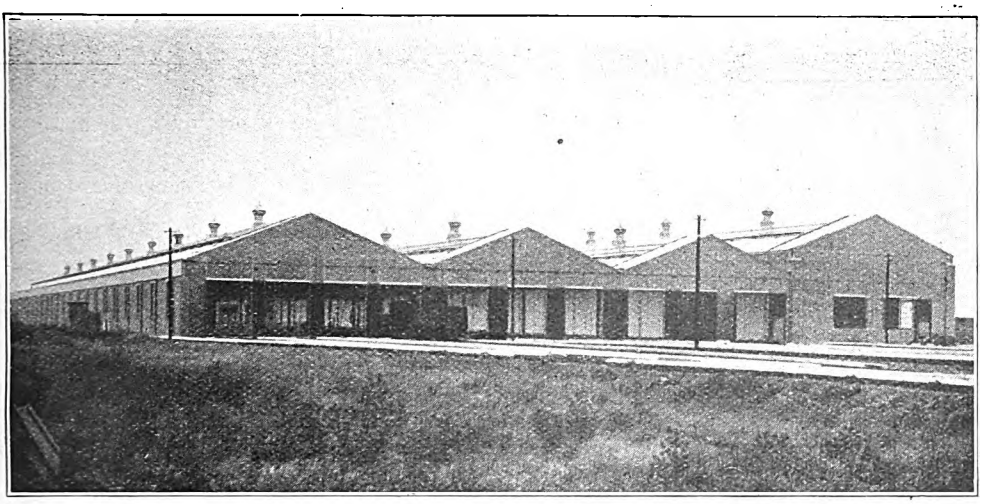

GENERAL VIEW OF NEW ELECTRIC CAR SHEDS, SOUTH GOSFORTH, L. & N.E.R.

Electric Car Sheds at South Gosforth, London and North Eastern Railway.

IN order to provide accommodation in replacement of the car sheds at Heaton, destroyed by fire some time ago, the London and North Eastern Railway recently brought into use new sheds at South Gosforth for housing electric rolling- stock used in the Newcastle district. The main building is 720 ft. by 190 ft., and has been designed in three bays, one of 68 ft. span and two of 60 ft. 10 in. A large number of the roof trusses are the residue of the trusses which were used in the erection of the wool sheds at Hull and originally formed the roof of a submarine shed erected during the war at Beachley, in Kent, and bought by the North Eastern Railway from the Admiralty.

The car shed roofs have been designed in such a manner as to utilise the old trusses with the new. The same remarks apply to the patent roof glazing and many other parts of the structure. The standing shed contains ten tracks and between each track is a pit built in concrete, reinforced where necessary with steel rods. These pits run practically the whole length of the shed and are lighted by fixed lights placed in recesses at intervals and also provided with wall plugs and flexible electric cables with hand lamps for inspection and other work under the trucks. Hot and cold water is also laid on to stand pipes which are distributed evenly over the area of the shed.

The outside walls of the building consist of 9-in. brickwork screens built in between the stanchions supporting the roofs, and the flooring is of concrete reinforced where necessary by expanded metal sheeting. Ample lighting is provided from the roof and also from the large steel framed windows in the side walls. The building is lighted at night by electricity and the shed is one of the largest in the country, having accommodation for 120 cars—12 per line.

The repair shop is the next in size and importance, being 425 ft. by 60 ft. 8 in., and contains two tracks with pits between as in the standing shed. A 30-ton overhead travelling electric crane runs the full length of the shed, and the building is top and side lighted electrically as in the case of the large shed.

This part of the contract was rendered extremely difficult owing to the nature of the foundation. At a depth varying from 4 to 11 ft. a stratum of running sand was found of varying thickness which necessitated a large amount of close sheeting and pumping to get through to

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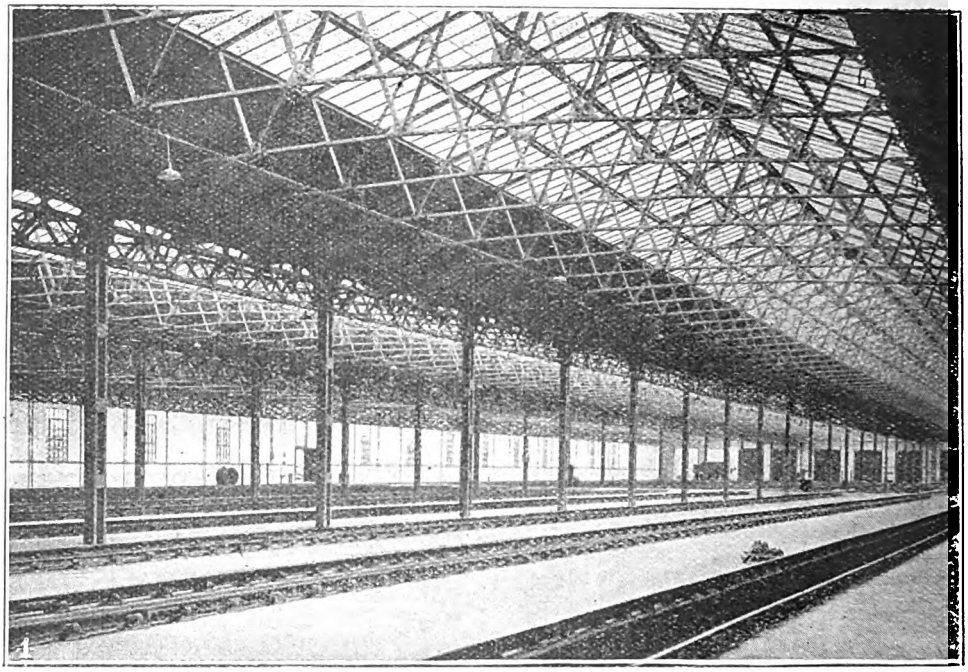
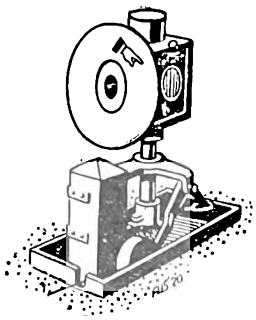


INTERIOR VIEW OF ELECTRIC CAR SHEDS.

the clay formation and also an extensive spread of the concrete foundations. The pits themselves are practically longitudinal channels carried on arches and formed in reinforced concrete which abut on to massive concrete piers resting on the clay about 11 ft. below floor level, thus forming a continuous concrete viaduct upon which the cars run. The whole of the steel and concrete works have been subjected to very severe test loads which are far in excess of any they will be called upon to bear, and the tests have been most satisfactory in every way.

No great difficulties were encountered during the construction of the other buildings. The work has occupied two years in erection and much credit is due to the contractors and supervising staff for the creditable manner in which they have overcome their difficulties and brought to a satisfactory conclusion a work of such magnitude and importance. The buildings were erected from the designs and under the supervision of the architect, Mr. Wilkinson, and the outside work under the District Engineer, Mr. Buscarlett. The contractors for the buildings were the Blackett Construction Company, of Stockton-on-Tees.



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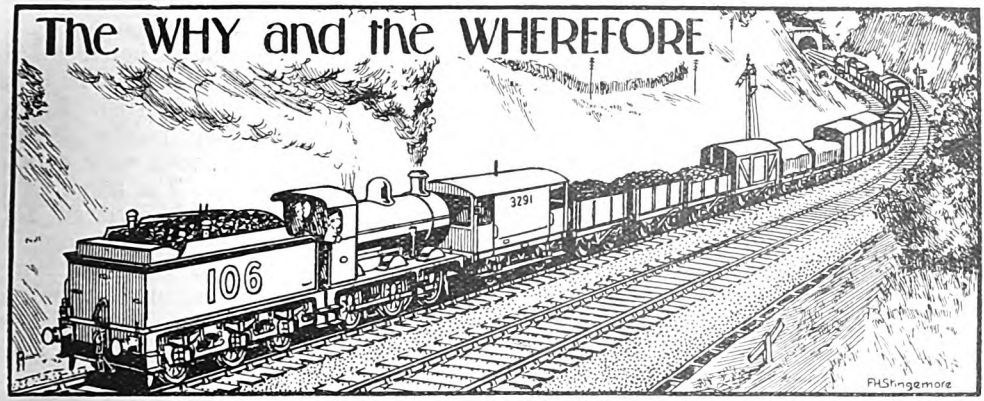

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, *33, Tothill Street, Westminster, London, S.W.1. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition* (1924) *of this standard railway reference work is in preparation and will be published in April next.*

Slip Coaches.

The chief drawback to the slip coach is that corresponding facilities cannot be given in the opposite direction, nor can passengers be taken up from the slipping station. At many places traffic has grown to an extent which renders it preferable to arrange for intermediate stops by trains in both directions rather than to serve the station concerned by a limited facility. More attention is now paid to improving facilities, both through and intermediate, than to mere speed. Further, the running of slip coaches entails selection of stock and provision of expert staff. There are many cases, too, where good facilities are now given by other trains, so that the need or justification for slip coaches off a through express no longer applies. So far as slipping is advantageous, the examples which still apply indicate that the value of the practice is fully realised. A complete list of current slip coach services was given in the October, 1923, issue.

[Reply to "SILURIAN."]

Distances on Railways.

Distances given by Mr. Cecil J. Allen and others in describing express runs, are usually quoted on the basis of the working time-tables. Unless you can obtain access to such publications, which are, of course, issued confidentially to the staff, it will be necessary for you to take the distances from *Bradshaw*. At the same time, you will generally find that within, say, the last two years, Mr. Allen has quoted the principal distances on all the important main routes, and by looking further back you would, no doubt, come across most of the others which you might require. Station distances are generally measured between the centres of stations, and distances to and from junctions (other than station junctions) between the junction signal-boxes.

[Reply to "SAFETY VALVE."]

The Belpaire Firebox.

Although the original Belpaire firebox was used in conjunction with a very wide grate, it has been applied mainly in connection with grates of narrow type. With the general favour of the wide type of firebox, as now used in America and largely in Europe, the changes of curvature associated with the Belpaire design no doubt explain to some extent the tendency to adopt the Wootten type of firebox in preference. This is probably one of the reasons why, as you point out, several American and other railways which previously adhered to the Belpaire design

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are now gradually falling into line with others in the use of the wide type.

[Reply to A. CURRAN.]

Double Transmission Locomotives.

In view of the fact that both a steam turbine and an internal-combustion engine are best suited to running at constant speed, it is found that considerable advantages may result from utilising a prime mover working under conditions best suited to it to drive a dynamo which will supply current for electric motors used for traction purposes, and whose operation is varied to suit requirements. Hence, the development of designs in which a constant running engine operates a dynamo to supply electric current to traction motors. As you mention, we have described attempts to apply the steam turbine direct, but that involves many difficulties.

[Reply to R. J. D.]

London Midland and Scottish Birmingham Expresses.

We understand that Midland three-cylinder compound 4-4-0 locomotives are being experimentally used for two-hour expresses between Euston and Birmingham, thus supporting your note in regard to the appearance of No. 1033 in charge of Kentish Town men on the 11.30 a.m. ex Euston. There will, no doubt, be many examples of interchanges of this kind. Your comment that Midland 0-6-0 tender engines of the Belpaire superheater goods class were regularly used during last summer on "North Western" local passenger services into New Street station, Birmingham, is noted.

[Reply to H. E. IKIN.]

London and North Eastern Railway Locomotives.

We have already explained that, for the time being at least, if not permanently, engines belonging to the various component companies retain their old numbers, with the addition of the letter C (Great Central), E (Great Eastern), N (Great Northern), D (North Eastern), B (North British) and S (Great North of Scotland). Presumably, new engines will be allocated to one or other section. "D" in the case of the North Eastern section refers to Darlington, the suffix letter for N.E. coaching stock being "Y" (York).

[Reply to "NORTHAMPTONIAN."]

Permanent Way Indications.

The boards you have noted on the Lancashire and Yorkshire section of the London Midland and Scottish Railway indicate the division points between stretches of line laid with rails supplied by particular makers. The name of the firm is indicated in abbreviated form, with the month and year of laying and the length of track in yards concerned. These indications are usually given where special observations or tests are in progress, but on some sections are shown systematically.

[Reply to "LANKY."]

Superheated "Precursor" Locomotives.

Seeing that the "George the Fifth" class is a superheated development of the "Precursor" class, there cannot be much difference between a superheated "Precursor" and a "George the Fifth" class engine. Obviously, therefore, it is equally correct to describe a "Precursor" class engine which has been superheated in either manner. It does not follow, of course, that "George the Fifth" splasher or extended smokeboxes have been added at the time of equipment with superheating apparatus.

[Reply to "CANDIDATE."]

Brading Harbour Railway.

The Brading Harbour Railway was incorporated in 1874. The Board of Trade Returns show that during its construction it possessed one locomotive in 1879, increased to two in 1881, but it owned no passenger coaches. It was opened for traffic in May, 1882, and worked by the Isle of Wight Railway Company, by which it was absorbed in 1898. Length of line from Bembridge to junction with the Isle of Wight Railway at Brading, and quay branch, 1 mile 76 chains.

[Reply to "BONCHURCH."]

Illumination of the Footplate.

It is inadvisable for brilliant illumination to be used on the footplate, to light up the cab fittings, as such a practice would interfere with the observation of signals at night. Some light is necessary to enable the crew to observe their water and pressure gauges, and small oil lanterns are used as being the most convenient and reliable illuminant.

[Reply to J. H. A. W.]

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Great Western Railway Locomotives.

We have, on several occasions, explained that engine No. 111, *The Great Bear*, does not work, and, so far as we are aware, never has worked, as far as Exeter or west thereof. Hence, it has never been used on the "Cornish Riviera" express. No. 98, the second of the original two-cylinder 4–6–0 class, is now No. 2998, and is named *Ernest Cunard*. This engine was built shortly after No. 100, which initiated the design.

[Reply to "REDGAUNTLET."]

London and North Eastern Railway Locomotives.

Are you sure that the 0–6–2 tank engine you noted shunting near West Tinsley bore the number 1145B shown in accordance with the new system? The letter B applies to North British Section locomotives. Great Central locomotives on the duplicate list had the letter B attached to their number, but this would not be shown in the manner now adopted with repainted locomotives.

[Reply to F. E. M.]

Locomotive Re-numbering, London Midland and Scottish Railway.

Presumably, London and North Western 4–6–0 locomotive No. 1914, *Patriot*, will retain its name and inscription plates when, in due course, it receives a new number, though its present number may have to give way to another, seeing that 1914 comes within the series allotted to Midland engines. Several other engines have been fitted with Ross "pop" safety valves.

[Reply to PRO—L. and N.W.R.]

East Coast Anglo-Scottish Services.

In cases where the time-tables indicate that passengers for, say, Edinburgh are not conveyed, it will usually be found that there is another train within a short period taking that traffic. The object is not to overload trains for further destinations with traffic for intermediate stations which is provided for otherwise. Such trains call at the stations mentioned, but only for picking up or for setting down passengers from certain stations.

[Reply to "INQUISITIVE."]

Locomotive Duties.

The fact that an engine of one of the latest designs is occasionally to be seen hauling a light train of a semi-local character, as, for example, a "Claughton" working a train between Crewe and Manchester or Liverpool, may be due to the requirements of arranging suitable duties. Other work performed by the engine on the same turn may be of a heavy main-line character.

[Reply to G. LOWRIE-FAIRS.]

Barry Locomotives.

These, together with other locomotives taken over from the various Welsh railways, will be numbered, lettered and painted as in the case of Great Western locomotives proper as they receive extensive attention in the shops. In renumbering, the engines take numbers vacant in the series allocated to Great Western locomotives of the corresponding wheel type or class.

[Reply to "CHEESEWRING."]

Passenger Communication Devices.

The passenger communication chain being now a self-contained device within each modern passenger coach, operating the brake, whistle and indicator on that coach alone, slip coaches are equipped in precisely the same way as ordinary coaches, and no disconnection of the apparatus is necessary on the part of the slip guard (as would have been the case in the days of the old continuous communication cord).

[Reply to F. L. OLDLAND.]

Colonial Premiers at Portsmouth.

We understand that one of the "736" class 4–6–0 locomotives worked the special train conveying the Colonial premiers and others to Portsmouth for the Naval Review on November 3. An engine of this class is, of course, admirably suited for working the severe gradients of the Portsmouth line. In fact, some of them now work trains on that route regularly.

[Reply to L.C.M.P.]

Naming Locomotives.

The general policy is, of course, decided by the Board of Directors, and occasionally they or the Locomotive Committee will suggest particular names. The actual names may otherwise be selected by the Locomotive Department or by a General Manager's Committee, or other body to which the work is delegated.

[Reply to "SILURIAN."]

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Liverpool Overhead Railway.

The through service between the Liverpool Overhead line and the then Lancashire and Yorkshire Railway to Southport was withdrawn in 1914, but a considerable number of Liverpool Overhead trains run to Seaforth and Litherland (London Midland and Scottish) station, in order to provide connections with practically all trains (except expresses) between Liverpool (Exchange) and Southport.

[Reply to F. W. ROWSWELL.]

P.W.R. Checks.

The abbreviations "P.W." and "P.W.R." indicate "Permanent Way" and "Permanent Way Repairs," respectively, thus explaining the cause of the trains whose running is recorded being checked. Service slacks apply at places where reduced speed is imposed by order, either because of curves or for other reasons. These, of course, apply to every train passing on the lines affected.

[Reply to M. R. C.]

Colours for Locomotives and Rolling Stock, Southern Railway.

While a number of passenger vehicles have appeared painted green and lettered "Southern Railway," and some of the ocomotives now bear the word "Southern" with a large numeral below, we are advised that no definite decision has yet been made as to the permanent liveries and lettering, &c., to be adopted by the company.

[Reply to A. J. C. and others.]

Continental Mail Services.

The fact that certain mails are now conveyed by the Newhaven-Dieppe night service does not indicate that mails are no longer conveyed by the Dover-Calais and Dover-Boulogne routes. Presumably an arrangement has been made for certain mails to be conveyed by the first-mentioned route, probably to relieve the others.

[Reply to "POSTAL."]

Sheffield and Rotherham Railway.

The original termini of this railway were in the Wicker at Sheffield, and at Westgate, Rotherham. The connecting line (then single) from Holmes station to Masborough, North Midland Railway, was constructed contemporaneously with the Sheffield and Rotherham Railway, both being opened on November 1, 1838.

[Reply to "HALLAMSHIRE."]

Mile Posts, Great Western Railway.

Presumably you refer to the quarter, half, three-quarter and mile posts. Of the two figures shown on each face, the upper indicates the number of miles from London or other measuring point, and the lower shows one, two or three strokes to indicate the quarter, half and three-quarter mile.

[Reply to "SAFETY VALVE."]

Southampton West Station.

The curve from Northam Junction to Tunnel Junction was opened in 1871. This agrees, therefore, with your suggestion that you travelled over it in 1875–77. Northam station itself is, however, not on this section of line, but adjoins it on the base line of the triangle.

[Reply to R. J. D.]

Early Sheffield Station.

The Sheffield station of the Sheffield, Ashton-under-Lyne and Manchester Railway (later the M. S. and L. Railway) was a temporary one in the Spitalfields, and having approximately the site of the present Bridgehouses goods station.

It was opened July 14, 1845.

[Reply to "HALLAM RISE."]

London and North Western Locomotives.

Black was adopted as the standard colour for passenger and goods engines in the time of the late Mr. F. W. Webb. This occurred some time in the 'seventies. Previously, they were green. The matter has been fully dealt with by Mr. E. L. Ahrons.

[Reply to "NORTHAMPTONIAN."]

L.M.S. Services on L.N.E.R.

Engines of several types have been tentatively tested on North London services working on the Great Northern section of the London and North Eastern Railway. Hence the appearance, mentioned by you, of a London and North Western 0-6-2 tank engine.

[Reply to A. MIALL.]

Loading Gauge Restrictions, South Eastern and Chatham Railway.

The largest type of Great Western Railway rolling-stock would not be allowed to work through between Reading and Dover, Southern Railway, though we believe it could be used as far as Redhill.

[Reply to J. JENNINGS.]

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Compound Locomotives, Great Western Railway.

The three French 4-4-2 compound locomotives are still in service. We believe they are generally employed on services in the Midlands, but cannot say whether they work at all to South Wales.

[Reply to J. JENNINGS.]

Railway Carriages.

In six-wheeled vehicles the centre pair of wheels usually has limited side play. Bogie vehicles have, of course, the flexibility to obtain which the bogie design is adopted.

[Reply to "SUBSCRIBER."]

Through Swansea-Hull Service, Great Western and London and North Eastern Railways.

These through coaches join and leave the Swansea–Newcastle express at Sheffield and travel between Sheffield and Hull via Doncaster.

[Reply to "WAVERLEY."]

Dorchester and Wareham, Southern Railway.

We are advised that the correct distance between these two stations is 14 miles 79 chains, from station platform to station platform.

[Reply to L. A. GARRARD.]

Great Indian Peninsula Brake Vans.

The ladder shown in the illustration reproduced on page 235 of the September RAILWAY MAGAZINE provides for access to the lamp and to a water tank in the roof.

[Reply to K. W. S. M.]

High Peak Line, L. M. S. R.

This line originally belonged to the London and North Western Railway. It is operated by locomotives, and both passenger and goods traffic are conveyed.

[Reply to R. HALKETT.]

North London Railway.

"Belmont" points out that London and North Western 0-6-2 coal engine No. 1009 was also tried on North London services over the Great Northern Railway.

[Further reply to "COLOUR LIGHT."]

London to Manchester by G.N. Route.

There was no occasion to mention this in the Summer Train Services article, as the service has not been revived since the war.

[Reply to P. G. CUNNINGHAM.]

London Midland and Scottish Railway Locomotives.

As already explained, express passenger locomotives are to be painted red, while black will be the colour for goods engines.

[Reply to J. H. M. PEEL.]

King's Cross-Harrogate-Newcastle Pullman Car Train.

You are correct in pointing out that this train rejoins the East Coast main line at Northallerton and not at Thirsk.

[Reply to "AUDLEY END."]

Distance from London to York.

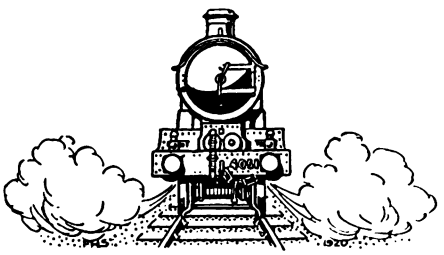
When first opened, trains travelled between London and York via Knottingley, hence the variations in distances.

[Reply to "EBOR."]

Rolling-Stock Numeration, L.M.S. Railway.

Particulars not yet available as to the system upon which rolling-stock is to be numbered to meet grouping conditions.

[Reply to P. DRUMMOND-HAY.]



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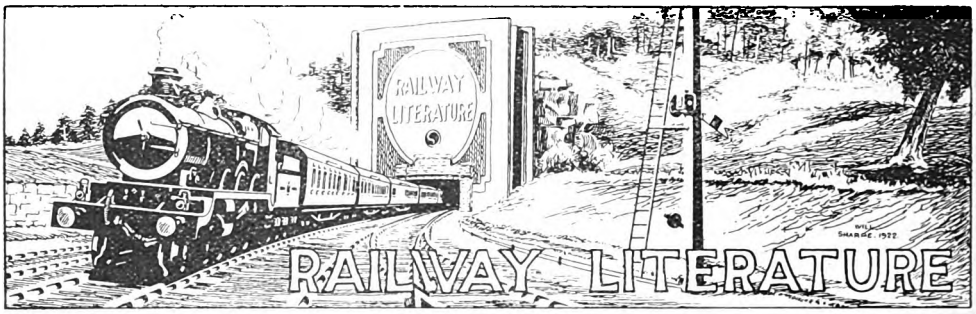

RAILWAY AMALGAMATION IN GREAT BRITAIN. By W. E. Simnett. [London: *The Railway Gazette*, 33, Tothill Street, Westminster, S.W.1. Cloth, 8¾ in. by 5½ in. 276 pp. Price 15s. net.]

As a member of the Railways Amalgamation Tribunal and a late director of the Ministry of Transport, Mr. Simnett was well qualified to undertake the production of this book, which is sure of a cordial welcome by all who are interested in railway history. There is no doubt that in America, India, Ireland and other parts of the world where the grouping of railways is under consideration, Mr. Simnett's painstaking contribution to railway literature will be of enormous value as it provides a ready means of ascertaining exactly what methods were, and are, being pursued in the grouping of British lines.

On the question of nationalisation, Mr. Simnett makes some very apposite remarks and he should be studied in detail. He discusses the subject with perfect freedom from bias, but he protests that railway operation should not be liable to political interference, save so far as a measure of public control is requisite for the safety and in the general interest of the community.

The Railways Act of 1921, which became operative on January 1, 1923, as Mr. Simnett states, "marks a decisive turning point in the relations of the railways and the State," but for good or for ill the revolution is accomplished; and for those who want in handy form a well-marshalled statement of facts, accompanied by fair and reasonable comment by one thoroughly capable of reasonable judgment, Mr. Simnett's book may be recommended.

BROWN AND OTHER SYSTEMS OF RAILWAY DISCIPLINE. By K. J. Norman Browne. [London: *The Railway Gazette*, 33, Tothill Street, Westminster, S.W.1. Cloth, 9 in. by 5½ in. 68 pp. Price 3s. net.]

A strict disciplinarian is not usually accounted a popular person, and perhaps this circumstance has arisen from the practice in the past of insufficiently tempering justice with mercy. Yet discipline in its true sense should be kind and reasonable, and the tendency in these present days is to make it so. Embodied in discipline are the attributes of a disciple; training; education; instruction and the government of conduct or practice; the training to act in accordance with rules; punishments inflicted by the way of correction; instruction by the means of suffering and the like.

In all walks of life discipline makes for the comfort of the individuals who form the crowd, and in railway life discipline also helps to ensure safety. Railway officers, and those of the rank and file who aspire to rise in the service and have control over other men, will do well to give close consideration of the systems set forth in the book under notice. The Brown system is not an untried theory; it is one that has been weighed in the balance of practice and not found wanting. It sweeps away all fines, suspensions and the wherewithal of the direct penalty method, and puts in place thereof what is known as the Record system.

In a preface to the book, Mr. Felix J. C. Pole, General Manager, Great Western Railway, commends the study of the Brown system to all railwaymen, but there is no reason why its sphere of usefulness should be confined to the railway world. Throughout industry there prevails the necessity for a closer co-operation and understanding between the employers and the employed, and the object of the book is to prove that discipline can be made a great improving force rather than a demoralising one.

SCALE MODELS. [Section "A" Model Railways, Bassett-Lowke Limited, London, Northampton and Edinburgh. Price 1s. net.]

There is an enormous fascination in the control and management of a railway, and although it is outside practical politics for every youth who enters the railway service, however devoted to the industry and enthusiastic in all that appertains to it, to become

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a Felix J. C. Pole or an Arthur Watson, it needs but the will and the expenditure of a certain amount of time and cash, both of which might be put to much worse purpose, for the aspirant for general managership, not only to control, but to possess a railway in miniature.

In meeting the wants of persons who desire to own model railways, and such people are to be found in all stations of life, Bassett-Lowke Limited have built up a big business as model manufacturers. The firm's catalogue for the 1923–24 season forms an attractive, profusely illustrated, book of 144 pages, 9 by 6 in., and should be in the possession of everyone who owns, or contemplates owning, a model railway.

Of course, premier place is given to the locomotive, but model railway requirements for steam, electric or clockwork traction are described in great detail. Carriages, wagon stock, stations, buildings and signalling are accorded much attention, while such sundries as platelayers' huts, water towers, miniature advertisements and posters are included. As the price of the book is so small—one shilling only—the devotion of further space in noticing it is unnecessary, as enough has been said to demonstrate how helpful it is to the model owner and the potential miniature railway manager. In writing to the firm concerning the catalogue, RAILWAY MAGAZINE readers, whether resident in the British Isles or overseas, should address their letters to Bassett-Lowkes' head office, Northampton.

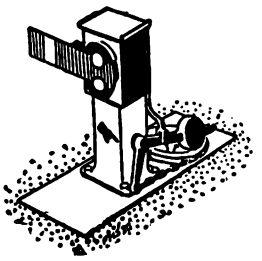
THE SUPERVISION AND MAINTENANCE OF STEAM-RAISING PLANT. By Charles A. Suckan. Ernest Benn Ltd., 8, Bouverie Street, London, E.C.4. Price 36s. net.

This well-produced volume of 347 large pages, with 250 illustrations of various kinds and 6 tables, is designed to emphasise the economies which can be effected by scientific management in the boiler house by describing the best practice, and with the aid of practical comment based on lengthy experience. Special attention is given to the importance of the "combustion engineer," or as he is described by the author, the "engineer-chemist." Part I deals with supervision, and includes a detailed study of types of power units, lay-out and efficiency, fuel economy methods, systems of organisation and operation, &c., followed by a chapter on combustion of various fuels, including utilisation of waste heat. Methods of firing, regulation of draught, and other factors receive attention as required. Section II deals with auxiliary apparatus and appliances, while Section III is concerned with the care of subsidiary plant. Section IV is concerned with management of staff, grades, duties, etc., including also the office staff, technical chemists, storekeepers, the records department and testing. Part II is headed "Maintenance," its subject-matter including inspection, boiler brickwork, "laying up," overhauling auxiliary plant, workshop organisation, repairs, etc.

Altogether this volume is one which should prove exceptionally useful to all concerned with the management, operation and maintenance of steam-raising plants of all kinds. Its range of subject-matter is wide, while a very complete collection of illustrations and statistical and tabular material and data is provided.

RAILWAY AND CANAL TRAFFIC CASES. Volume XVII. By W. A. Robertson, B.A., and W. S. Kennedy, LL.B. Sweet and Maxwell Ltd., 3, Chancery Lane, London, W.C. 2. Price £1 12s. 6d. net.

This volume brings the series of Reports of Cases decided by the Railway and Canal Commissioners, issued by the publishers mentioned, substantially to date, including also cases dealt with by the Railway Rates Tribunal. It is, of course, prepared for use in legal circles, and therefore contains a useful digest, as well as very full reports of proceedings in the respective cases. Special interest attaches to the section reporting proceedings before the Railway Rates Tribunal, in that this deals with the form of schedules of standard charges, deposit of schedules for season tickets and workmen's fares. A useful index is also included.



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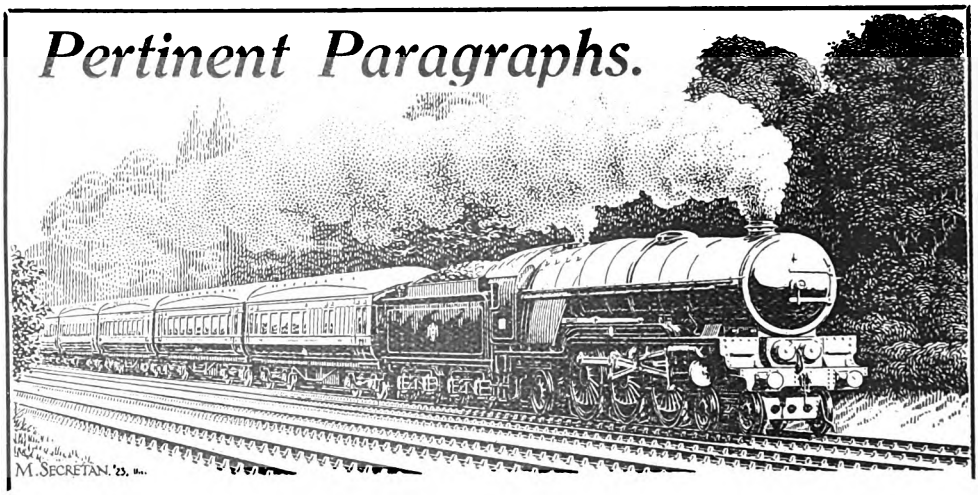
Pertinent Paragraphs.



Our Frontispiece.

THIS shows, in the correct colours and with the new style of lettering, numbering and lining adopted by the London Midland & Scottish Railway, one of Mr. G. Hughes' four cylinder 4–6–0 locomotives, as used on the Western Division. The class is, of course, a well known one, and although most of these engines are used on the late Lancashire & Yorkshire lines, several work on the London & North Western main routes. The particular engine illustrated formerly bore the number 1676. Leading dimensions are as shown on the plate, while the class was more fully described in a recent number. Our plate is a reproduction of an oil-painting by F. Moore.

Railway Bills in Parliament.

FOR the session of 1924 each of the four great railway companies is promoting a Bill dealing with new railways and works and a large number of other matters. At the same time each has a Bill to authorise variations in their dock and harbour charges. The London & North Eastern and the London Midland & Scottish are, in addition, promoting Orders under the Private Legislation Procedure (Scotland) Act relating to alterations of their dock and harbour charges in Scotland, whilst the London Midland & Scottish also has a Scottish Order relating to the acquisition of lands in Scotland, and a further Scottish Order embodying some of the general provisions contained in the Bill. Two railways in the Underground Group, the Central London and the Metropolitan District, are also promoting a Bill.

The four larger companies appear to be asking for similar powers with regard to such matters as stone-throwing on railways, prevention of trespass in and improper use of railway carriages, substitution of a card index for the shareholders' address book, and the closing of transfer books. Last year the Great Western Company obtained special powers as to arrest in certain cases, and the forthcoming Bills of the other three groups will contain powers as to arrest. Additional capital powers will be applied for by the London & North Eastern, the London Midland & Scottish and the Southern Railways. Variations are sought of absorption schemes so far as concerns two light railways—the Leek & Manifold Valley and the Mid-Suffolk—which gave rise to considerable discussion before the Railways Amalgamation Tribunal. New powers as to housing accommodation for employees are being taken by the London Midland & Scottish and the Southern Railways, whilst the London & North Eastern and the Southern Bills will provide for the constitution of superannuation and pension funds and for the transfer to new funds of the members of existing funds.

Proposed New Railways and other Works.

Two new subways are proposed by the Central London Railway in connection with Bond Street station. The Metropolitan District Railway desires to construct an additional through line at Whitechapel. The Bill will also empower the District, London Electric, Central London and Southern Railway Companies to make agreements as to the alteration, electrification, working, user, &c., of the Kensington and Richmond and of the Wimbledon and Fulham lines of the Southern Railway.

Additional powers will be taken by the Great Western Railway with reference to new railways, to deviations and widening of existing railways, and to the acquisition of lands in 16 counties. The proposed new railways (six in number) include one at Kinver, three which form a connection

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with the coast section of the Cambrian Railway of the company at Pwllheli, one in Cardiff, and one in connection with the Cornwall Minerals Railway. A deviation of part of the Canon's Marsh railway in Bristol and a deviation and widening of the Roath Dock branch in Cardiff are also proposed. The Bill will also confirm deviations of the Dartmouth and Torbay and of the Newquay and Cornwall Junction Railways.

L.N.E. and L.M.S. Proposals.

SEVERAL new works are proposed in the London and North Eastern Railway Bill, including connections between the Great Northern and City Railway at Drayton Park and the Canonbury lines at Finsbury Park, widenings between Liverpool Street and Stratford and between Fenchurch Street and Stratford, a new railway connecting the Alexandra Park and the Enfield branches, a connection just outside Lincoln between the Sleaford and Market Rasen lines, new railways at Scunthorpe and Frodingham, a new railway at Rufford, widenings near Pyewipe Junction and between Hull and Selby, and the conversion into cutting of the Thurgoland and Hattersley tunnels on the Sheffield and Manchester Railway. The South Yorkshire Joint Line Committee will also be authorised to construct a line connecting the Firbeck Light Railway with Harworth Colliery. It is proposed to abandon a portion of the Newmarket Branch Railway.

London Midland and Scottish Railway widenings are proposed at Kibworth, between Broadholme and Ambergate, and between Hall Lane and Seymour Junction. Extension of time is required for the completion of five railways, and it is proposed to revive the powers and extend the time for the purchase of the lands required for the Barking and Upminster widening. Power is asked to discontinue and remove Church Road station, Birmingham.

Southern Railway and Miscellaneous Bills.

Two reclamation walls, 5 jetties, 2 graving docks, and 2 new railways in Southampton are contemplated by the Southern Railway, as well as a reclamation wall at Medina Wharf, Cowes. New connections are proposed between the Tooting, Merton and Wimbledon line and the authorised Wimbledon and Sutton Railway, with the abandonment of the present authorised connection at Wimbledon station. The company also contemplates the acquisition of the Wimbledon and Sutton undertaking. Other new railways proposed are connections between the Horsham and Leatherhead line of the Brighton section and the South Eastern and South Western sections near Dorking and Bookham respectively. Certain abandonments and alterations at Ramsgate and Margate are also proposed.

In the King's Lynn Docks and Railway Bill it is proposed to amend the Company's Act of 1889 with reference to the leasing of warehouses. Although the greater part of the system worked by the Londonderry and Lough Swilly Railway is in the Free State, its Londonderry terminus is in Northern Ireland, and the company has a Bill in the Imperial Parliament to authorise an increase of borrowing powers and further powers of creating and issuing debenture stock. The Bill will contain provisions for preserving the rights and interests of the Government and Parliament of the Irish Free State.

Two Bills are being promoted to deal with the scheme authorised by the St. Just (Falmouth) Ocean Wharves and Railways Act, 1919. One Bill provides for the abandonment of the undertaking, and the other for a revival of powers and extension of time. Under the title "West Thurrock Wharf and Railways," a Bill is to be deposited for the incorporation of a company to construct a wharf and road at West Thurrock, in Essex, and railways connecting such wharf with the Tilbury section of the London Midland and Scottish Railway.

Each of the four great companies is applying for powers to alter rates, &c., at these various ports, both in England and Scotland.

How Special Traffic is Catered for on the London and North Eastern Railway in Scotland.

PUBLIC interest in matters pertaining to football in Scotland has increased considerably within recent years, particularly since the introduction of a system of promotion by merit in the Scottish Football League. The result has been that greater enthusiasm is being shown by followers of the various football clubs, and in this connection the policy of the London and North Eastern Railway has been to encourage them to travel by rail to support their club when playing away from the home ground. A great incentive in this respect is that a cheap fare at about single fare for the double journey is granted on such occasions, and when it is anticipated that a full train load of passengers or more will travel, one or more special trains are provided as required.

The present state of the industrial world has naturally led to increased emigration from Scotland to the United States of America, Canada, &c., and the London and North Eastern Company is taking an active part in the transportation of these passengers to the port of embarkation. So far as America is

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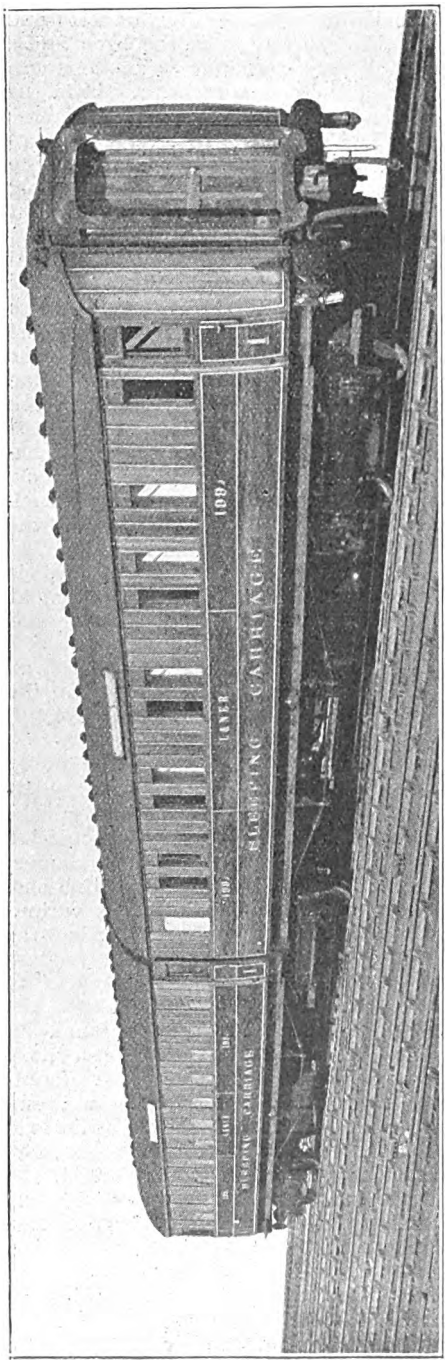
concerned, the exigencies of the quota system have necessitated these passengers being conveyed in large numbers and, consequently, the company has to provide special trains for their conveyance. Within recent months the London and North Eastern has conveyed a big proportion of the Scottish emigrant traffic to London, Southampton, Glasgow, &c.



NEW ARTICULATED SLEEPING CARRIAGES, L. AND N.E.R.

Circular Tours in Scotland.

ALTHOUGH nothing is probably farther from the minds of the travelling public at the moment than the question of where they will spend their summer holidays in 1924, the matter is already occupying the attention of those responsible for the preparation of programmes and literature which are issued giving information as to cheap facilities, &c. So far as Scotland is concerned, circular tour tickets for use by rail, motor and steamer are issued from certain stations at reduced fares, and the travelling public can visit the beautiful and historical parts of the country expeditiously and in the greatest comfort.

Prominent amongst these places may be mentioned Melrose and the Scott country, Rob Roy and Prince Charlie's country; also the famous "Trossachs Tours," embracing the Clyde, Loch Lomond, Aberfoyle, &c., and the "Three Rivers" and other tours of the Great North of Scotland section. Amongst the circular tours may be mentioned those embracing the West Highland Railway, Fort William, Caledonian Canal, Inverness, Aberdeen and the Tay and Forth Bridges. These cheap circular tours are a great boon not only to our own countrymen, but to the large number of tourists from other countries who generally visit our shores in the summer time.

Fish Traffic on the London and North Eastern Railway.

THE fishing industry is an important one in Scotland, absorbing in its ramifications a large number of workers. The white fishing is carried on continuously from all harbours on the coasts, particularly as regards the London and North Eastern Railway, Aberdeen, Granton, Newhaven and Mallaig. Herrings in the seasons are landed in large quantities at Stornoway, Mallaig, Buckie, Fraserburgh, Peterhead, Anstruther, St. Monans, Newhaven and Eyemouth. There are important sprat fishings at Dundee, Kincardine-on-Forth and Newhaven, while crabs are found in abundance all along the East Coast from the Moray Firth to the Tweed. Salmon caught in the seas on the East Coast and in the Scottish rivers is of the highest quality and is in great demand throughout the British Isles. These products of the sea and rivers are marketed over a wide area, extending to Dover on the south-east coast and Penzance on the south-west coast of England. To enable this to be done the London and North Eastern Railway has augmented the ordinary train service by special fish trains. The longest distance

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of the system and were recently introduced in the Southern area of the company.

Caledonian Reminiscences.

MR. J. MCNAUGHTON, writing from Dunblane, Perthshire, sends some remarks upon train working and locomotive practice on the Caledonian Railway in the '80's, which may be quoted as follows :—

" In an old Caledonian working time-table of the middle '80's the 5 p.m. train ex Buchanan Street, Glasgow (which is still one of the crack trains to the North), reached Dunblane in 55 min. with the same stops as now, namely, Larbert, Stirling, Bridge of Allan and Dunblane. The fastest timing now, notwithstanding the big engines and other improvements, is 61 min. The same train in 1887, I think it was, reached Dundee West exactly at 7 p.m.—2 hours for the 84 miles. The fastest timing now to Dundee is 2 hr. 16 min., with Bridge of Allan and Dunblane cut out as regards stops, but with Gleneagles thrown in instead. Bridge of Allan and Dunblane stations being situated on the worst part of the Kinbuck bank - 1 in 69 at Bridge of Allan.

" The engines which tackled the 1887 proposition were the celebrated 7 ft. 2 in. Dundee bogies, Nos. 125–129, designed by the late Mr. Benjamin Connor, and rebuilt in 1887 by that deservedly famous locomotive engineer, the late Mr. Dugald Drummond, of North British, Caledonian and London and South Western Railway renown. They were handled by such ' crack ' drivers as the late ' Wull ' Gellatly and ' Sandy ' Mitchell, of Dundee, and ' Jimmy ' Haddow, ' Geordie ' Hill and ' Willie ' Lamb, of Glasgow, over a much lighter ballasted and railed road than now. When thinking of these old ' warriors ' of the past I recalled to mind another ' hero of the footplate,' the late ' Bob ' Scott, of Stirling, affectionately known as ' Old Bob,' in the early '90's. ' Old Bob ' had No. 77A, one of the world-famous 8 ft. 2-in. singles of Benjamin Connor, and when working her up to speed used to remark under his breath, at intervals, ' Gie her time, man, gie her time,' meaning, of course, that in a few seconds you would see some grand work being performed. ' Old Bob ' used to take the 6.45 p.m. stopping train from Dunblane to Perth in the early '90's with the 8-ft. 2-in. single No. 77A, and as this train started from Dunblane simultaneously with the 6.45 p.m. for Callander, there used to be a miniature railway race every night, as the two trains ran parallel for a considerable distance. The Callander train was worked by the late ' Jimmy ' Robb, of Callander, with a 6 ft. rebuild of the 430 class, all now scrapped. Will Peddar, his fireman, was afterwards a driver on the Uganda Railway, East Africa.

A Scottish Railway Race.

" THE excitement of the race, coupled with the fame of the drivers, rose to such a pitch that the overbridge on the route was lined with hundreds of spectators (cinemas being *non est* in those days). On one occasion ' Old Bob Scott ' walked up the line before starting time and sanded the rails with his hands in front of No. 77A, so that she would get a good grip on giving her steam. The 8-footer usually got the best of it, that fact being made known to all concerned by ' Old Bob ' giving ' cock crows ' on his whistle while drawing away from ' Old Jimmy Robb ' with the smaller wheel. These old drivers were not wanting in humour, as there used to be a station master at Greenloaning who went by the appellation of the ' Dorkin,' owing to his being a breeder of that branch of the hen family, and who, I understand, used to get into a ' passion ' when these old ' heroes of the road ' used to ' cock crow ' to him on their whistles when passing Greenloaning.

" Fireman Will Peddar, mentioned above, was about the last of these fearless drivers brought up under the old school. It is quite a well-known story in the Stirling and Perth districts that, on one occasion at least, after becoming a driver, he took what was termed the Monday morning cattle train, consisting on this occasion of two cattle trucks loaded with livestock and a goods brake van, from Dunblane to Perth—28 miles in 28 min., start to stop—with No. 1550, an old stove pipe funnelled, outside cylinder engine of the old Allan pattern of Crewe, now long since broken up, and once one of a numerous design on the Caledonian."

How the Public Pick Up Railway Terms.

THERE are some people who profess to be entirely uninterested in " railways and all their works," apart from the necessities of travel and questions of cost and facilities. Yet railway matters are continually being touched upon in the daily and weekly newspapers, and constantly arise in course of conversation ; so much so, that even the " uninterested person " seems to obtain at least a nodding acquaintance with railway phrases and terms. The results are sometimes " peculiar," especially when a general newspaper writer uses them for descriptive or other purposes in regard to aspects which he understands very imperfectly, if at all. That they should thus be " picked up " is, however, all to the good, in that their use indicates that the " uninterested " attitude is not absolute and may be rather a " pose "

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than a fact. Also that railway announcements and descriptions of railway developments are read, that posters and pictures are looked at, and that what is seen on the railway is not altogether without its influence.

Pullmans and Pacifics.

WE are constrained to write in these terms after reading a short article in a recent issue of *The Daily Express*, published after a spell of November weather, under the title of "Northward-Ho in a London Fog." So far as it went the article was quite a good one. The point to be emphasised is, however, the indications that the writer had "picked up" some pertinent railway terms and applied them "under fog conditions." Presumably it was King's Cross station he had specially in mind. At that station are to be seen "Pacific" locomotives, also Pullman cars, facts of which the passenger is continually reminded by picture and poster. Consequently "through steaming windows of indistinct Pullmans you see tables laid for lunch," although "you glimpse a board on the carriage roofs: 'Newcastle, Edinburgh, Aberdeen.'" Unfortunately for the writer's accuracy, Pullman cars do not yet work through to Edinburgh and Aberdeen from King's Cross, and reference is obviously made to the usual restaurant cars. But no engine has yet been attached until: "A Shape appears, headed by a light that slowly crawls nearer. The clink-clank of connecting rods comes to you and the hiss of steam. Then, suddenly, a Pacific locomotive, huge, terrible and magnificent, glides past you towards the waiting carriages." Possibly, a "Pacific" locomotive was actually concerned, but had it been merely an ordinary "Atlantic" we are afraid that "J. S." would have been none the wiser. Still, whether he had the engine right and the Pullmans wrong, it is good to find that the the fact that both *are* to be seen at King's Cross has become known to people other than those who study and find a real interest in railway and locomotive matters.

Operating Districts on the Southern Railway.

IN view of the fact that, as a result of reorganisation, practically all the old frontier arrangements between the London & South Western, London, Brighton & South Coast and South Eastern & Chatham Railways are disappearing, and new districts have been set up both for engineering and operating purposes, special interest attaches to the manner in which the new districts or divisions have been arranged. It is further worthy of note that the Engineering Districts and the Operating Divisions do not agree. It is true that for many purposes it would appear to be desirable to have the same division points for all departments. There is, however, no vital reason why this should always be so, in that a district having a large number of heavy engineering works may not necessarily be correspondingly busy in regard to traffic. In many instances, too, it is desirable to include the whole of certain routes in one traffic division, although the lines concerned may come under the oversight of two or even more District Engineers.

Six Divisions Arranged.

FOR operating purposes six divisions have been set up, none of which pays more than limited attention to the previous ownership of the lines concerned. The London (East) Division, of which Mr. E. J. Missenden has been appointed Divisional Operating Superintendent, with headquarters at London Bridge station, covers practically all the London suburban lines, both Brighton and South Eastern & Chatham, to points beyond Dartford, Chislehurst, Chelsfield, Selsdon Road and Coulsdon stations with the various branches included, and as far as Epsom in the case of the "Brighton" route thereto. The London (West) Division, of which Mr. A. H. Hoyle is Divisional Operating Superintendent, with headquarters at Waterloo, covers all the London & South Western suburban lines, together with the main routes beyond to Southampton Docks, both via Basingstoke and via Alton, and the Portsmouth line via Haslemere, together with the Hayling Island branch and the Isle of Wight lines.

The Eastern Division, of which Mr. F. A. Ellender has been appointed Divisional Operating Superintendent, with headquarters at Dover, covers practically all the Kentish lines east of Dartford, Chislehurst and Chelsfield, the main line from Tonbridge east of that station, and certain of the branches extending into Sussex. The Southern Division, of which Mr. C. J. C. Latham is Divisional Operating Superintendent, with headquarters at Brighton, includes the greater portion of the late "Brighton" system south of the suburban area, except for the Portsmouth district lines, while it also includes the Tunbridge Wells and Hastings section of the late South Eastern & Chatham Railway. The Central Division, of which Mr. E. Hight has been appointed Divisional Operating Superintendent, with headquarters at Southampton, includes all London & South Western lines west of the Basingstoke and Southampton Docks line as far as Salisbury and all the way to Dorchester and Weymouth, together with the Fareham

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group of lines between Southampton and Portsmouth. The Western Division, which has been placed under Mr. D. S. McBright, with headquarters at Exeter, includes the West of England main line west of Salisbury, and all lines west of Exeter.

Result of Fare Reductions.

THE Ministry of Transport's statistics for August last show that the total number of passenger journeys (excluding season ticket holders) was 119,289,714, an increase of 8,540,543, or 7·7 per cent., compared with August, 1922. Excluding the London "Tubes" and the Metropolitan District Railway, the increase in journeys was 9,776,420, or 10·6 per cent. The journeys made by passengers at reduced fares increased by 11,272,900, but the journeys at full fares decreased by 2,732,357. Against this, however, passenger receipts showed a decrease of £285,385, or 3 per cent. More passenger train-miles were run than in any month since monthly particulars became available (viz., in January, 1920), and the figures show an increase of 1,482,304, or 6·6 per cent. over August, 1922.

Railway Accident Reports.

ADMITTEDLY these always afford interesting reading, and when railway methods and practices are brought out in evidence much is to be learned therefrom, quite apart from the details of the particular accident under review. Unfortunately, however, space will not permit of extended reference in these pages, for which reason attention has been given only to accidents of outstanding interest and importance. In deference to the wishes of several readers, however, rather more attention will be given thereto than has been the case for some time past, and in succeeding paragraphs various aspects of several recent interesting accidents are briefly covered. There were, however, several others which justify a few remarks which may be made here.

On July 11 last, at London Bridge station, an explosion occurred in one of the motormen's compartments of a South London electric train which had come in from Victoria. As the compartment was in the middle of the train it was unoccupied and little serious damage was done. A few passengers in a train alongside suffered from broken glass. As the electrical equipment only was concerned, Major Hall's report, though a lengthy one, is devoted entirely to evidence on the electric side. He concludes that the accident was due to the ignition of an explosive mixture formed by the vaporisation of the oil in the high-tension switch of the motor coach involved. This was due to discharges to earth inside the switch, resulting from cracks in one of the four porcelain insulators, attributed to mechanical causes associated with the design of the insulator and probably aggravated by the high temperature on the day when the accident occurred. Replacement of old "South London" insulators by the improved "Crystal Palace" pattern was recommended, and certain other suggestions made, but no serious criticisms as to either Brighton electric practice or the responsible staff were offered. In fact, Major Hall pointed out that this was the only electrical train equipment accident reported since electric traction was inaugurated on the Brighton line in 1909.

Drivers' Responsibility on Double-Headed Trains.

IN the case of a very slight buffer stop collision at Euston on September 26, the only point was the apparent uncertainty as to which of the two drivers of a double-headed train was responsible for brake control. The 12.13 p.m. up Irish mail consisted of 14 eight-wheeler and 2 twelve-wheeled vehicles, load 463 tons, drawn by "Claughton" class engines Nos. 1177 and 194 (pilot). Total length was 923 ft. 6 in. over buffers. Both engines came from Crewe, but drivers had been changed at Rugby in the case of the train engine. The same two engines with the same men had worked the train on the previous day, so that the respective drivers were not strange to one another. The collision itself was a very slight one, the only point at issue being the practice which had arisen without official sanction of the train engine driver being regarded as having control of the train. There was the further complication that while each driver thought the other was taking chief control, the train engine driver applied steam very slightly, thinking that the train would stop short. Major Hall's report places a certain degree of blame upon this driver as well as on the pilot driver and upon the shed foreman and other officials who had allowed irregular understandings as to drivers' responsibilities to arise, emphasising the view that the driver of the leading engine was the proper person to take chief control as specified by the regulations.

A Light Engine Collision.

LIEUT.-COLONEL A. H. L. MOUNT'S report upon the collision which occurred on July 12 at West Hartlepool station affords an example of the possibilities of misunderstanding which may arise where traffic movements are made under the control of hand signals only. The 8.48 p.m. up

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passenger train to Yarm (consisting of five bogie vehicles and 0-4-4 tank engine No. 1887) was standing at the up platform when it was run into in rear by 0-4-4 tank engine No. 1695 running "light." The latter engine was proceeding via the up road through the station to the locomotive shed, under permission given by a backing signal, the regulation in force providing that "when a driver moves in obedience to the lowering of a backing signal he must not assume that the line is clear as far as the next stop signal." At the signal box concerned—Clarence Road—it had become the custom to display a green hand signal after the lowering of No. 8 signal, to warn drivers proceeding from the down to the up road via the crossover that the platform ahead was occupied. The main issue was, therefore, as to whether a hand signal was displayed, as to which the evidence was directly contradictory. The driver of the light engine, a man with 30 years' service, stated emphatically that although he looked at the box when passing he saw no hand signal. He saw the standing train at a distance of about 65 yards, and appears to have taken prompt measures to pull up as soon as the obstruction was observed. In fact, had it not been for the greasiness of the rails at this part of the platform, as the result of fish traffic, he might have been able to stop clear, while a station inspector who observed the collision which, he said, took place at walking pace, had the impression that although the engine was skidding, it would come to a stand behind the train.

Hand Signalling as a Cause of Misunderstanding.

THE fireman on No. 1695 confirmed his driver's evidence, referring particularly to the latter's care in respect of hand signals, but one of the two signalmen on duty in Clarence Road box claimed that a green flag was displayed, and that when the driver failed to acknowledge the signal by whistle he shouted to him as the engine passed the box, the other signalman confirming this so far as he saw his colleague's action.

Colonel Mount expresses the opinion that "the main responsibility for this collision must rest upon Driver Morell, in that he failed to exercise sufficient caution in accordance with the company's regulation for dealing with movements controlled by backing signals. At the same time the straightforward statements of both enginemen in regard to the omission of the hand signal cannot be disregarded. Moreover, the evidence of the signalmen leads me to think that the flag was displayed later than usual, possibly not before the engine reached the box. Having regard, therefore, to local practice, I am of opinion that Signalman Sivills should also accept some measure of responsibility for failing to make the enginemen understand the information it was customary under the circumstances to give them, and which it was the intention to convey." The report concludes with some suggestions for improving the working at this station, including steps already taken by the company in regard thereto, suggesting also that a fixed signal should be provided to cover through movements of the kind concerned, No 8 signal being restricted to its more correct function of controlling shunt movements through the crossover only.

Accidents on Irish Railways.

THESE are not now covered by the inspecting officers of the British Ministry of Transport in so far as the railways in the Free State are concerned, but they are inquired into by the Free State Ministry of Industry and Commerce. Two reports, by Mr. T. M. Batchen, have been recently issued. One relates to a derailment on April 24 last, on the Dublin and South Eastern, due to a fall of rock at Bray Head between the northern end of No. 1 tunnel and a short covered way, a distance of about 140 ft. The train consisted of a 2-4-0 type tender engine, four passenger coaches, three vans and two wagons. Falls of rock at this point are not infrequent and watchmen are always on duty. Speed is restricted to 20 m.p.h. The flagman on duty on this occasion had passed the scene of the slip at 10.34 a.m. on his way to the south, or further end of the tunnel to, as usual, "flag" the train by. All was clear then, so the fall evidently occurred when the train was in the tunnel and the sound was drowned by the noise of the train. The train ran into the obstruction and was wholly derailed. No passengers were injured but the fireman fell off the engine and rolled down the slope. Although shaken he was not hurt.

This is one of the most difficult pieces of railway construction in Ireland to maintain. It is built for two miles along the precipitous face of Bray Head, and at the particular spot where the accident occurred the cliff rises on the landward side to a height of several hundred feet, and on the sea side the slope dips about 70 ft. to low water level. Mr. Batchen states that it is estimated that about 200 tons of rock and clay became dislodged and fell on the line from a point on the cliff outside the railway company's property. A considerable amount more was taken down during the week following the accident, as it was considered dangerous. The company's engineer estimated that he had removed altogether since the accident about 700 tons. An extra watchman was

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put on during the operations, and the speed of all trains was reduced to 5 m.p.h. when passing this place. The speed restriction was still in force when Mr. Batchen reported, and would remain so until the company's engineer was satisfied that all the dangerous rock and boulders had been removed or made safe by the building of concrete buttresses.

Traffic Operation under Difficulties.

THE second accident in question occurred on May 1 at Amiens Street loop line station. This station is the property of the City of Dublin Junction Railway, and is worked by the Dublin & South Eastern Company. The signalling is operated from the Great Northern Railway's signal-box, which had been destroyed by rebels on April 26. The accident under notice arose out of the signalling being out of use.

All purely Dublin and South Eastern movements, independent of the Great Northern lines, were controlled entirely by the former company. A man named Macdonald acted as flagman and a shunter named Reilly was in charge of points leading off the main line into a turntable siding. The station is approached by a rising gradient of 1 in 60 combined with a curve of 12 chains radius. The train in question consisted of 10 loaded wagons and a van, of the total weight of 144 tons 10 cwt., and was drawn by a 2-4-0 tank engine weighing, in working order, 40 tons.

Flagman Macdonald went to pilot the train into the station, but said nothing to shunter Reilly as to the turntable points. Reilly, though, expected that the train would stop short of them seeing that the wagons had to be backed into some sidings. Neither did Macdonald instruct the driver. The train had to start from "dead" up the bank, and therefore set back some distance to make a run for the incline. This was done so effectively that the train was, in the opinion of the station master, Macdonald and Reilly, going at 45 m.p.h. when it entered the station; the driver, however, only acknowledged to 10 to 12 m.p.h. The train, anyway, entered the turntable siding at such a speed that, despite the application of brakes and of steam in back-gear, the engine ran over the turntable and off the line at the end of the siding—there were no buffer stops—and, breaking down a 20-in. thick wall, fell into the telegraph office of the G.P.O. No railway servants were hurt, but two Post Office clerks were injured.

Mr. Batchen considered that the estimates of the speed by other witnesses than the driver had been exaggerated; that it was about 20 m.p.h. on the incline and 5 m.p.h. when it ran off the line. Whilst the main blame rested on the pilotman, the driver was not exempt; he ought not to have "rushed" the incline but have driven with such care as would have enabled him to stop in the shortest possible space beyond the top of the incline.

Broken Connecting Rods.

ON May 28, at Betley Road, near Crewe, when the 11.50 a.m. express from Euston to Manchester was travelling at about 65 or 70 m.p.h., the load consisting of 14 bogie coaches, drawn by 4-6-0 "Prince of Wales" class engine, No. 1355, assisted by "Renown" class 4-4-0, No. 1947, the right-hand connecting rod of the train engine broke, the boiler being pierced both in the barrel and in the firebox by the broken end. The driver of No. 1355 was severely scalded, but fortunately no serious damage occurred otherwise. The fireman escaped injury, as he was at the time in the tender drawing down coal.

This engine failure, judging from Major Hall's report to the Ministry of Transport, following upon several other failures of a more or less similar class affecting engines fitted with the Joy valve gear, has apparently caused considerable disquiet at Crewe. The evidence shows that the matter had received very close attention. In fact, it is an open secret that the fitting of "Prince of Wales" class locomotives with indirect Walschaert valve gear as to No. 964, *Bret Harte*, as illustrated in the July, 1923, number of the RAILWAY MAGAZINE, is due directly to the weakness which has been shown arising from the fact that when the Joy gear is used a jack link connection has to be made with the connecting rod. Furthermore, the rule had already been made that connecting rods on such engines should be examined after a mileage of 20,000 had been completed, and this period has been further reduced to 10,000 miles, with the instruction that this examination must be carried out in a good light on the bench and not under the engine.

Arduous Duties of "Prince of Wales" Class Engines.

ADMITTING, however, this weakness, Major Hall emphasises in his report that the question has probably arisen more particularly in consequence of the very severe duties now performed by these engines, as compared with their predecessors, the "Experiment" class, while the fact that they are superheated introduces complicating factors which are even now not fully understood. So far as the failure under notice is concerned, Major Hall does not find fault either with the design of the rod or with the

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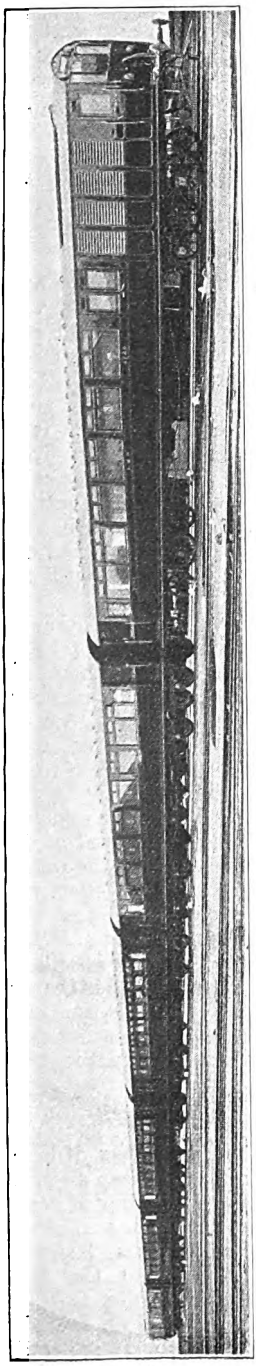

NEW ELECTRIC ROLLING STOCK, LONDON MIDLAND & SCOTTISH RAILWAY.

For the electric services in the London district, a number of additional vehicles have recently been constructed at the Wolverton Carriage Works, under the supervision of the Carriage and Wagon Superintendent, Mr. R. W. Reid. By courtesy of Mr. F. E. Gobey, Divisional Carriage and Wagon Superintendent, Wolverton, we are enabled to illustrate one of the new trains. The new trains are painted in the colours now adopted for passenger rolling-stock.

examinations to which the rod had been subjected. The engine had, in fact, been carefully examined only on the previous day. It appears, however, that the broken rod was inferior in physical quality to the other mainly because of a higher phosphorus content in excess of that allowed by specification, combined with overheating during annealing. Tests in regard to this and others do not "account definitely for the initial development of this fracture in a rod which had not been stressed considerably above the calculated degree." The report concludes with the recommendations, *inter alia*, that particular attention should be paid to producing a high degree of polish upon these rods before they are put into service, and that consideration should be given to further methods for the prevention of undue compression and temperature rise when steam is shut off.

"Locust Specials."

THE Rev. E. Beal, of Somerville, Tsolo, Cape Colony, South Africa, sends a cutting from the *East London Daily Despatch*, describing the running of a "Locust Special," which has been experimentally operated on the main line south of Bloemfontein, with the object of fighting the locust pest. The train consists of an engine, a van, and a two-thousand gallon tank containing locust poison, the preparation manufactured by the Government. On the tank is mounted a Worthington steam pump supplied with power from the engine and operating two powerful sprays, which are capable of covering a considerable space on either side of the line. "Thus fitted the 'Locust Special' is a factor to be reckoned with by the mighty armies of voetgangers, and while, unlike the farmer with his portable sprays, the locust train has a limited field of operation, there is no limit to its fighting line, and it is capable of setting a death-trap for all hordes penetrating its lines." So successful have been its experiments that a second locust train is being equipped.

L.M.S. Locomotive Notes.

COMMENTING upon the "Pertinent Paragraphs" in the November number under this heading, "Belmont" points out that only one of the five "Claughtons" had then been renumbered, No. 2511-5971. In attempting to explain the system upon which renumbering will be carried out, he suggests that the order will be that in which engines were "put to stock" in any particular month, and not necessarily according to the exact dates on name and number plate. On that basis he anticipates that Nos. 484, 1177, 1407, 1599, 2179, 2499 and 2511 (seven engines

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instead of five) will become Nos. 5965-5971 in that order. Similarly he concludes that Nos. 1914 (*Patriot*), 69, 178, 194 and 972, all dated January 1920, but put to stock in May, 1920, will become Nos. 5964 and 5960 to 5963 respectively. "Belmont" mentioned further that on the basis of renumbering so far effected the "Prince of Wales" class will run from 5600 to 5844: also, as No. 310, *Achilles*, has been numbered 5290, he suggests that the "Precursors" will be Nos. 5200-5246. Other anticipations are that the 5 ft. 6 in. 2-4-2 tanks will begin at 6600, the "Precursor" tanks, possibly Nos. 6785-6834 or 6800-6849, the C class 0-8-0's, Nos. 8953-8967, the C1 class 8968-9001, the D class 9002-9064, the E class 9065-9153, and the G1 class 9154 and onwards.

Further Grouping Developments.

CONTINUING his anticipations, "Belmont" suggests that Lancashire and Yorkshire Crewe-built 2-4-0 No. 731 is to become No. 10000, the 4-4-0's will apparently begin at 10100, the 4-6-0's 10400-10454, the rail motors 10600 and upwards, 2-4-2 tanks of Class 5, from No. 10650 to about 10800, followed by the Class 6 engines. Nos. 11300 to about 11600 for 0-6-0 tanks, followed by 0-6-2 and 2-6-0 tanks. The 2-6-2 tanks will probably become Nos. 11700-11716, 0-6-0 goods engines (Classes 25, 27 and 28) will commence about 12000, and the 0-8-0 engines (Classes 30 and 31) at 12700. These series will include Furness, Maryport and Carlisle and Garstang and Knott End locomotives. With regard to Scottish locomotives "Belmont" mentions that it is reported that a Caledonian 4-6-0 is No. 14756 and that the Glasgow and South Western 4-6-4 tanks are to be Nos. 15400-15405. These anticipations, the accuracy of which can only be shown in due course, are distinctly of interest, though we do not either endorse or correct them.

"Belmont" further remarks: "With reference to L.N.E.R. matters *Lloyd George* has been replaced at King's Cross shed by *Valour*, still in the old G.C.R. livery. On Thursdays a through excursion is worked from Immingham to King's Cross by a G.C. Section locomotive; it arrives about 10.30 a.m. and returns about midnight. No. 475c, a new Gorton-built 4-6-0, has been to Hornsey, also Stratford 0-6-0 No. 518 and 1267, the latter being in L. and N.E.R. black livery. No. 475c is not fully painted yet. "Pacifics" No. 1480 and 1481 have recently worked to London, the former being shedded at Grantham. No. 1481 was on the N.B. Section till recently. No. 1473 and 1479 have the letter N added after the *tender* numbers, but the engine numbers have no suffix. A 0-6-2 T No. 1561 also has the letter N on the tank sides (but not on the number plates or buffer beam). Stirling 0-6-0 No. 834N has just been through the Plant, but retains the small type of boiler. Stirling 0-6-0 ST No. 1050N and 1051N have also been through recently: No. 1050N retains the domeless boiler, but No. 1051N now has a domed boiler: both engines have condensing apparatus."

Other Items of Interest.

"Two 2-6-0's No. 823 and 824 have been completed at Ashford; and No. 825 is reported to be running trials, painted grey and lettered Southern Railway. No. 686, a C class 0-6-0, shedded at Gillingham (Kent), has been painted L.S.W.R. goods green and is lettered Southern Railway. It is possible that the Brighton brown livery *may* be adopted for the Southern passenger engines, but this is not yet finally settled. Drummond 4-4-0 No. 284 has recently been rebuilt with latest standard smoke-box, etc. The sandboxes are still combined with the driving splashers."

In the case of the Great Western Railway and with reference to illustration of No. 8 (2-6-2T) shown on page 402, there are two engines of this class, No. 7 completed about the middle of July and No. 8 early in August. Several of the older tank engines are now having the words "Great Western" painted on the side tanks and in many cases the number plates are removed to the cab or bunker sides. Several of the 4-6-0's have been repainted in the latest style, including Nos. 2901, 4034, 4040, but the brass beading has not been replaced yet.

Mr. S. M. W. Hann points out that L.B. and S.C.R. 0-6-0 locomotive No. 430 is still at Brighton, and suggests that No. 428 is the one taken over by the S.M.J. Railway. He further corrects "Belmont" by stating that G.E.R. No. 191 does not retain the blue livery.

Developments in the Furness District.

"FURNESSIAN" sends particulars of locomotive developments in the Furness district, as noted by him, including a number of items which are likely to interest other readers, as follows:—"Several ex-Furness Railway locomotives are now painted in the new L.M.S. colours, and these include ex-F.R. 0-6-0 No. 3, now L.M.S. No. 12480, ex-F.R. 0-6-0 No. 24, now L.M.S. No. 12505, and ex-F.R. 4-4-0 No. 130, which is now L.M.S. No. 10185. Also a 0-6-2T is painted black and numbered in the 11,000's. Before the L.M.S. colours and numbers were definitely

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fixed engines came out of Barrow shops in their old livery but without the F.R. on tenders or tanks. With regard to the Furness Railway 4-6-4 T's, which have all been in the shops for general repairs and paint, these are now employed between Millom and Carnforth, with one trip a day to Whitehaven (on the 5.35 a.m. mail ex Barrow) and one to Lancaster (3.5 p.m. ex Barrow). The five engines work seven turns in a day, and all of these are passenger jobs, except one which commences by working a goods train from Barrow-Carnforth and returns on the 11.5 p.m. ex-Carnforth to Barrow, where all these engines are shedded.

"From Carnforth, where the following 4-4-0's are shedded—36, 46, 131 and the newly-painted L.M.S. 10185 (old 130), three passenger turns are worked through to Whitehaven, these being the 5.20 a.m., 7 a.m. and 1.30 p.m. ex Carnforth, returning on the 10.15 a.m., 11.35 a.m. and 7.5 p.m. ex Whitehaven. The Whitehaven men also work through to Carnforth on one turn, this being the 2.45 p.m. ex Whitehaven, returning on the 7 p.m. ex Carnforth. During the summer Midland 4-4-0's, usually from Leeds shed, worked through on excursions to Lake Side via the Levens Junction loop line. Also Midland 4-4-0's worked through to Eskmeals on Sundays, with special trains in connection with the Safety in Mines Experimental Station there. At present Midland Railway goods locomotives from Leeds shed work through to Barrow on coal trains, returning next day with empty wagons. Alternately Furness Railway men from Barrow shed work through to Leeds on empty wagons, returning next day with a loaded coal train, there being one train each way per day on this service."

Renumbering L.M.S. Locomotives.

AFTER the earlier paragraphs based upon "anticipations" supplied by "Belmont" had been set up we have been favoured by Mr. G. Hughes, C.B.E., Chief Mechanical and Electrical Engineer, London Midland and Scottish Railway, with complete particulars as to the renumbering of locomotives which have now come into the ownership of that company. An outline of the classification, with some notes thereon, is now given, and comparisons can be made with the suggestions made by "Belmont," though he is not correct in all cases. It is hoped to include a systematic study in greater detail next month.

The order of classes is: (1) Passenger tender engines; (2) passenger tank engines; (3) goods tank engines; and (4) goods tender engines. The order of wheel types is:—

Passenger tender.—2-4-0, 0-4-2, 4-2-2, 4-4-0, 4-4-2, 4-6-0.

Passenger tank.—0-4-2, 2-4-0, 4-4-0, 2-4-2, 0-4-4*, 4-4-2, 4-4-4, 0-6-2, 0-6-4, 4-6-2, 4-6-4.

Goods tank.—0-4-0, 0-4-2, 0-4-4, 0-6-0, 0-6-2, 2-6-0, 2-6-2, 0-8-0, 0-8-2, 0-8-4.

Goods tender.—0-4-0, 0-4-2, 0-6-0, 2-6-0, 4-6-0, 0-8-0, 2-8-0.

All locomotives are classified as 0, 1, 2, 3, 4 or 5 class goods or passenger, for determining which take earlier numbers. Where two groups of similar power are concerned the older series takes the lower numbers. Passenger engines are classified in increments of 0·5 ton tractive effort at 50 m.p.h., and goods engines in increments of 0·75-ton tractive effort at 25 m.p.h. Where engines already have names they will be retained, but no new names will be given on any section.

	Numbers reserved.
Midland Division—	
Passenger tender engines ..	1–1199
Passenger tank engines ..	1200–1499, 2000–2219
Goods tank engines ..	1500–1999, 2220–2289
Banking engines	2290–2299
Goods tender engines ..	2300–4999
Western Division A—	
Passenger tender engines ..	5000–6399
Passenger tank engines ..	6400–7199
Goods tank engines ..	7200–7999
Goods tender engines ..	8000–9999
Departmental engines ..	Not numbered
Western Division B—	
Passenger tender engines ..	10000–10599
Passenger tank engines ..	10600–11199
Goods tank engines ..	11200–11999
Goods tender engines ..	12000–13999
Northern Division—	
Passenger tender engines ..	14000–14999
Passenger tank engines ..	15000–15999
Goods tank engines ..	16000–16999
Goods tender engines ..	17000–17999

Midland Division engines retain their numbers, so far as Midland stock is concerned, with the exception that 0-6-2 T Midland Railway 2180–2193 become London Midland and Scottish 2220–2233: 0-6-0 (Kirtley) Midland Railway 2303/11/15, 2320/28/33/88/37/47/49/54/93/56/95/57/60/66/99 become London Midland and Scottish 2382 to 2399; and 0-6-0 W.T. No. 1601 and 1604 become London Midland and Scottish 1605 and 1607. This enables engines received from the N.S.R. and S.M.J. to be renumbered more satisfactorily to type. S.M.J. No. 13 (2-4-0)

* The M. & C. 0-4-4 T (L.M.S. 10618) is an exception, as it precedes the 2-4-2 T (L.M.S. 10619–10950).

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becomes London Midland and Scottish 290, and the goods engines become London Midland and Scottish 2300–2311. (No. 2303 is the Stroudley 0-6-0 obtained from the London, Brighton and South Coast Railway a few years back.)

N.S. engines are grouped as follows :—

4-4-0	No. 595–599	(Power Class 2.)
0-4-4T	No. 1431–1439	(Power Class 1.)
2-4-0T	No. 1440–1451	
2-4-2T	No. 1454–1459	
0-6-0T	No. 1550–1603	(1599, late 23, Power 3, others Power 1.)
0-6-4T	No. 2040–2055	(Power Class 3.)
4-4-2T	No. 2180–2186	
0-6-2T	No. 2234–2273	(2265 and 2270–3 Power 3, others Power 2.)

Owing to the fact that Western Division A departmental locomotives are not included, the 2-2-2 *Cornwall* does not find a place in the above list, though the Caledonian single No. 1123 appears as No. 14010. Old London and North Western railmotor cars are also omitted for the present.

Wirral engines become Nos. 6758–6762, 6770–6, 6830, 6850–1, and 6948–9 ; Furness, Nos. 10002, 10131–10146, 10185–8, 10619–20, 11080–5, 11100–4, 11258, 11547–62, 11622–44, 12000–14, 12065–76, 12468–83, and 12494–512 ; Maryport and Carlisle, Nos. 10005–7, 10010–13, 10618, 11259–60, 11563, 12077–82, 12484–93, and 12513–4 ; Cleator and Workington Junction, Nos. 11564–8, and Knott End, Nos. 11300–2 and 11680.

In Scotland the numbers are thus distributed :—

Caledonian.—14010, 14100–115, 14290–365, 14430–508, 14600–26, 14650–5, 14750–61, 14800–3, 15000–1, 15020–31, 15100–240, 15350–61, 16000–39, 16100–2, 16150–73, 16200–376, 16500–5, 17000–20, 17101–2, 17230–473, 17550–692, 17800–4, 17900–15, 17990–7.

Glasgow and South Western.—14000–2, 14116–270, 14366–78, 14509–21, 14656–74, 15241–54, 15400–5, 16040–9, 16080–5, 16103–117, 16377–9, 16400–27, 17021–75, 17100, 17103–212, 17474–524, 17750–64, 17820–30.

Highland.—14271–85, 14379–422, 14522–3, 14675–93, 14762–9, 15010–7, 15050–4, 15300–7, 16118–9, 16380–3, 17693–704, 17916–30, 17950–7.

Glasgow and Paisley Joint.—16050–1 (0-4-0 tender).

L. & N.E.R. COAT-OF-ARMS.

The Coats-of-Arms of the companies comprising the L. & N.E.R. were reproduced in the February, 1923, RAILWAY MAGAZINE.

The technical description of the Arms of the new company, as authorised by Heralds' College, is :—

"Argent on a Cross Gules between in the first and fourth quarters a Griffin segreant Sable in the second a Rose of the second leaved and slipped proper and in the third quarter a Thistle also leaved and slipped proper the Castle of Edinburgh proper between four Lions passant guardant Or. And for the Crest On a Wreath of the Colours Issuant from Clouds of Steam the figure of Mercury proper."

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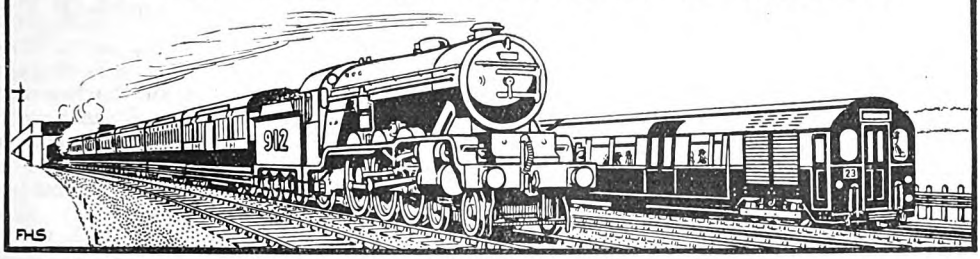
WHAT THE RAILWAYS ARE DOING.



As from December 1, 1923, the Right Hon. H. G. Burgess has been appointed Deputy General Manager of the London Midland and Scottish Railway. Mr. Burgess was in charge of the London and North Western Railway general business in Scotland for five years, and for twenty years was General Manager for Ireland, being responsible for the working of the company's Irish shipping and railway traffic. For the same period he served as Managing Director of the Dundalk, Newry and Greenore Railway, in which the London and North Western Railway was the principal shareholder. For sixteen years he was a director on the Dublin and South Eastern Railway, and for four years of that period acted as deputy chairman. For twenty years he was an elected member of the Dublin Port and Docks Board, but resigned when the war imposed special duties in regard to Irish transport. For ten years he was a member of the Dublin Local Marine Board, and for eighteen years a Commissioner for Carlingford Lough. The war period added considerably to Mr. Burgess's responsibilities. He was Director of Irish Transportation, acting on behalf of the Ministry of Shipping and the English and Irish Railway Executive Committees, and he acted as the Coal Controller's representative in Ireland. Mr. Burgess became Director of Irish Transport, Ministry of Transport, in September, 1919, but in 1920 returned to the London and North Western Railway to be Principal Assistant to the General Manager, his responsibilities being widened on the amalgamation of the London and North Western and Lancashire and Yorkshire Railways, January 1, 1922, and again on the formation of the London Midland and Scottish Railway, January 1, 1923.

THE LATE MR. C. BUSK,

Continental Traffic Manager, Great Eastern Section, Southern Area, L.N.E.R.

* * *

RECENT railway obituary includes Mr. Charles Busk, who had held the position of Continental Traffic Manager to the Great Eastern Railway since 1898. Under the London and North Eastern Railway he held the corresponding office in regard to the Great Eastern Section. Mr. Busk entered Great Eastern service in 1878, in the goods department. Later he was attached to the Continental Rates section, of which eventually he became chief. In 1898 he was appointed Continental Traffic Manager. In this capacity Mr. Busk was associated with the remarkable development of the Harwich routes to the Continent, while the growth and special favour of the Hook of Holland services must be credited largely to his foresight, initiative and attention, which extended even to the lay-out and equipment of the passenger accommodation of the splendid turbine vessels. Mr. Busk was a member of the Sub-Committee of the General Managers' Conference in connection with the International Régime of Railways, and in regard to maritime ports. He was one of the British delegates to the International Union of Railways and had a seat on the

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Passenger and Accounts Commissions. He attended most of the European time-table conferences, and was Chairman of the London and North Eastern Railway's Continental Services Conference. Several foreign distinctions had been conferred upon him, while he was a member of various Anglo-European and international trade and other associations. During the great war he had much to do with the maintenance of food supply services from Holland and for the conveyance of parcels to British prisoners of war in Germany.

* * *

By the death of Lord Shaughnessy on December 10, the railway world has lost one of its most famous magnates. Thomas George Shaughnessy was born at Milwaukee in 1853. At the age of 16 he entered the purchasing department of the Milwaukee & St. Paul Railway. In his thirty-first year he became assistant to the general manager of the Canadian Pacific Railway. In 1891 he was elected a director and eventually vice-president. In 1899 he was made President. In 1901 he was knighted and in 1916 a peerage was bestowed upon him. He is succeeded by the Hon. W. T. Shaughnessy, K.C., also a director of the Canadian Pacific Railway.

* * *

Mr. W. J. Thorrowgood, Signal and Telegraph Superintendent under the Chief Engineer, Southern Railway, has been elected Chairman for 1924 of the Railway Electrical and Telegraph Engineers' Conference.

* * *

Mr. S. W. Frost has taken the honorary general secretaryship of the Great Eastern Athletic Association. Letters on association business should be addressed to him at Engineer's Office, 89, Liverpool Street Station, E.C.2.

* * *

Mr. James Briggs, C.B.E., late Engineer-in-Chief of the Midland Railway, has been enrolled as an Honorary Associate, and Messrs. G. Cook and F. W. Hunt, Carriage and Wagon Department, Derby, and G. F. Ordish, General Superintendent's Department, Derby, have been elected Honorary Serving Brothers of the Order of the Hospital of St. John of Jerusalem in England, and this has been sanctioned by His Majesty the King, the Sovereign Head and Patron of the Order. The thanks of the Grand Prior and the Chapter General, engrossed on vellum, have been awarded to the following, as an acknowledgment of their distinguished services to the ambulance department, and in otherwise carrying out the objects of the Order:—Messrs. R. Mosley, E. R. Beesley and E. J. Atherley, Chief Mechanical Engineer's Department, Derby; T. Burnham,

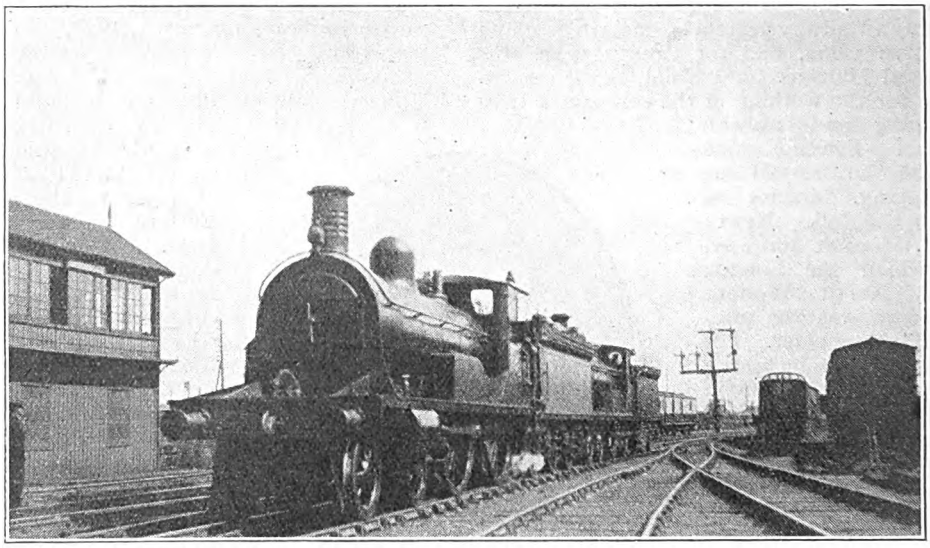

Photo.] [*E. A. Gurney-Smith.*

AN INVERNESS-ABERDEEN "THROUGH SERVICE" COMBINATION.

L.M.S.R. (Highland) and L.N.E.R. (Great North of Scotland) 4-4-0 locomotives coupled together at Inverness.

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General Superintendent's Department, Derby. Thanks of the Ambulance Committee of the Order on parchment in recognition of distinguished services in furthering the objects of the Association have been awarded to the following :—Mr. F.W. Smith, Engineer's Department, Derby; Messrs. G. F. Munns, C. W. Daniels and W. Malin, General Superintendent's Department, Derby; Mr. R. Middleton, Chief Mechanical Engineer's Department, Derby; and Mr. W. H. Swan, Goods Department, Derby. Mr. James Briggs has been interested in the ambulance movement since 1891, and was a member of the Midland Railway Ambulance Committee from its inception in 1894 to March, 1923, when he retired from the service, and in consequence withdrew from the Ambulance Committee. He was five times Chairman of the Committee. The success of the ambulance movement on the Midland Railway was largely due to his efforts, and this was more particularly the case with regard to the Engineer's Department. Mr. Ordish was the first Secretary of the Midland Railway Ambulance Committee, and is now a member of the Committee, whilst Messrs. Cook and Hunt have also rendered very good service to the Order.

* * *

DESPITE the after-effects of the previous day's electioneering, an excellent number of members gathered at the Railway Club on December 7 to hear a lecture by the President, Mr. Cecil J. Allen, A.M.Inst.T., A.I.Loco.E., on "The Production of Iron and Steel for Railways." The lecture was illustrated by a fine collection of diagrammatic and photographic lantern slides, explanatory of the manufacturing processes dealt with. The lecturer traced the methods of reducing iron ore to metallic iron in the blast furnace, and then went on to outline the Bessemer and open-hearth methods of steel production, laying stress on the important distinction between acid and basic steel. The final consideration was that of the rolling of the steel into rails, plates, structural sections, and all the various forms in which rolled steel is so familiar a product. In conclusion, remarkable statistics were given in respect of one large steelworks in the Middlesbrough area, whose magnificent plant formed the basis of many of the illustrations, mentioning that this particular works has 92 miles of standard gauge lines on the premises, of which the main lines are fully signalled as in standard practice, worked by 84 locomotives and 3,100 wagons of various sorts which never leave the works.

* * *

AT the Railway Club headquarters, 65, Belgrave Road, London, S.W.1, on Friday evening, January 11, Lord Monkswell will lecture on "Compound Locomotives."

* * *

A LANTERN lecture was given recently by Mr. Cecil J. Allen, A.M.Inst.T., A.I. Loco.E., to the members of the Middlesbrough and District Railway Lecture and Debating Society. The audience of about 200 included contingents from the Hartlepools, Stockton, South Bank, Redcar and other surrounding centres. For the occasion the large hall of the Cleveland Technical Institute was utilised. Mr. V. M. Barrington Ward, District Superintendent, London and North Eastern Railway, Middlesbrough, and President of the Society, was in the chair. The subject of the lecture, which was illustrated by a fine series of 70 slides, was "Railways: Their Engineering and Locomotives," and Mr. Allen prefaced his remarks with the claim that railway men, even though they might be concerned only with the operating of the trains, should also be familiar with the principles of railway planning which helped to set their operating problems and the principles of locomotive design which went towards solving them. Many diagrammatic and photographic slides were employed to make clear the considerations underlying the planning of a railway, and especially the overcoming of the obstacles which nature places in the engineer's way. The second part of the lecture was occupied with the principal factors in locomotive design, which the lecturer described as "cylinders sufficiently large to develop the tractive power demanded by the operating officials, a boiler producing steam in sufficient volume and with sufficient rapidity to fill the cylinders, and sufficient adhesion weight upon the driving wheels to transmit the developed power to the rails." A vote of thanks to the lecturer, proposed by Mr. W. Thurgood, Trainmaster, London and North Eastern Railway, Middlesbrough, was carried with acclamation.

* * *

MR. F. E. MACKAY desires to direct the attention of everyone interested in railway photography to *The Railway Postal Photographic Society*, which has been formed for the purpose of bringing into communication with one another all concerned in railway photography, and for providing a more efficient means of dealing with this subject. The Society provides, in a most efficient manner, the means for the assisting all those who participate in the photographing of trains and railway scenes. There are three sections—viz., Photographic Section, circulating portfolios of members' work for criticism and advice; Exchange Section, enabling the exchange of railway photographs between

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members; Historical Section, the object of which is to secure old and historical photographs of locomotives, trains and general railway views. The Society's notebooks, &c., deal in detail with the photographing of trains, and the proper development and production of prints. During the past year a great improvement has been noted in the numerous entries in the Society's portfolios, which are always full of attractive railway photographs. The annual subscription is 5s., and further particulars can be obtained from the Hon. Chief Secretary, Mr. M. W. Earley, 97, Hamilton Road, Reading, Berks.

* * *

It is intended by the London Midland & Scottish Railway in the near future to undertake extensive repairs to Mossgiel Tunnel, situated on the old Glasgow and South Western main line near Mauchline, Ayrshire. This structure was built over 75 years ago and forms part of what was originally known as the Kilmarnock and Cumnock extension of the Glasgow, Paisley, Kilmarnock and Ayr Railway, and was first opened to traffic August 9, 1848. The tunnel is 2,050 ft. in length with one airshaft about midway. The ground through which it lies rises to a maximum height of 104 ft. above rail level and is mainly of red sandstone. It is lined with brickwork formed from bricks burned near the site at the time of construction Owing to wastage of the brickwork from age and other causes it has been decided to overhaul the structure thoroughly and where necessary to reconstruct it. To enable this work to be carried on without interruption to the heavy traffic which this line carries, single line working through the tunnel will be adopted while operations are in progress. Strong travelling shields constructed of steel will be used to enable the defective portions of the tunnel to be demolished and rebuilt with safety to the traffic and to the workmen engaged. The work is to be effected under the company's own administration and will be carried out during the 24 hours in three shifts for six days in the week. The workmen, a considerable number of whom will be employed, will be housed in hutments to be erected near the work. A transmission line 5 miles in length to carry electrical energy from Kilmarnock to the site of the work is in course of construction, and will afford power for the air compressors and other plant. It will also enable the works to be lighted electrically. The work at this tunnel, which passes through the heart of the Burns Country, is interesting as it recalls the four years from 1784 to 1788 spent by Scotland's national poet as tenant of the farm of Mossgiel.

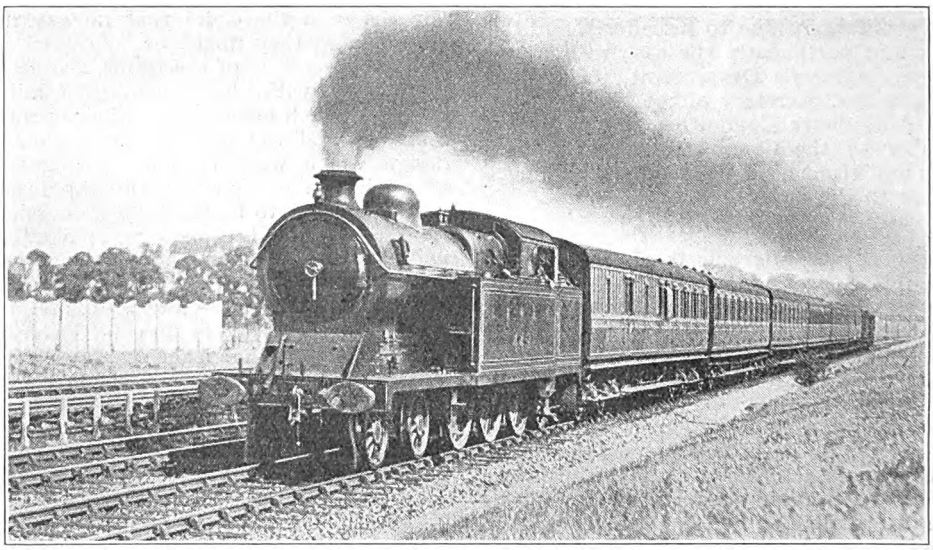

Photo.] **SCOTTISH ROLLING STOCK IN ENGLISH SERVICE.** [*F. E. Mackay.*

L.N.E.R. Marylebone–Aylesbury train near Harrow.
Great Central 4-6-2 tank engine and train of North British vehicles.

* * *

The London Midland and Scottish Railway is installing at Grangemouth Docks a

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35-ton new electric coaling crane, of which the following are particulars :—

Lifting capacity	35 tons.
Weight	315 tons.
Radius	57 ft.
Speed, lifting	35 tons at 50 ft. per minute and any wind pressure up to 10 lbs. per sq. ft.
Speed, tipping	Full range not to exceed 7 seconds.
Speed, sluing	35 tons at 450 revs. per minute.
Speed, travelling	60 ft. per minute.
Motors, lifting	200 b.h.p.
Motors, tipping	200 b.h.p.
Motors, sluing	60 b.h.p.
Motors, travelling ...	60 b.h.p.
Factor of safety with 35 tons load	7½.

Marginal stability to be maintained with 60 tons.

The crane spans two roads of rails, and will expedite the loading of coal.

* * *

In connection with the holidays which take place at certain seasons of the year, Christmas, New Year, Easter and Whitsuntide, and during the whole summer season extending from May to October, it is the practice of the London and North Eastern Railway in Scotland to issue cheap return tickets at single fare and a-third for the double journey from selected stations on the lines previously served by the North British Railway to the principal stations in England and Wales, including the Channel Islands and the Isle of Wight. The validity of these tickets is, as a general rule, for a period of eight or fifteen days, with the proviso that the passengers must travel by specified trains in each direction. These bookings have been greatly taken advantage of by holiday-makers. Special consideration is being given to the facilities that may be offered to the public for travelling to the British Empire Exhibition, which opens at Wembley in 1924.

* * *

Facilities afforded by the London and North Eastern Railway in the matter of dock accommodation are most up-to-date, and their ports on the Firth of Forth have shown a welcome return to the pre-war volume of trade. Particularly is this the case at Methil, where the shipment of coal during the 10 months ended October, 1923, exceeded the corresponding period in 1913. At Bo'ness also the London and North Eastern Railway is dealing with a larger tonnage as compared with pre-war days, and altogether the prospects are bright for 1924. Of course, the large traffic could not have been handled with expedition unless the facilities available were adequate, and the docks controlled by the railway in question have proved that they are capable of dealing with large tonnages in a most efficient and expeditious manner.

* * *

In consequence of the disastrous fire which occurred at the London and North Eastern High Street Goods Warehouse, Glasgow, at the beginning of 1922 re-organisation was necessary in respect of the traffic hitherto dealt with there. The work of repairing the damage caused by the fire, which was very extensive, has been completed. The machinery and appliances which were a feature of this important Goods Station have been restored, and the company is again in a position to deal with the large volume of traffic offering. The warehouses and stores which were to some extent destroyed by the fire have also been re-built, and are available for occupancy.

* * *

The Firth of Clyde, with its numerous arms, Loch Long, Loch Goil, Gareloch, Holy Loch, Loch Fyne and others, not forgetting the far-famed Kyles of Bute, abounds in scenery unsurpassed in beauty in Scotland, and a finely-appointed fleet of steamers owned by the London and North Eastern Railway places this natural paradise within the reach of all. The company's port of embarkation is Craigendoran, from whence steamers ply to all parts of the Firth and regular sailings to and from Dunoon, Rothesay, &c., are maintained in connection with an excellent train service. Loch Lomond with its myriad isles is also a continuous source of pleasure to the seeker after the beautiful, and a regular steamer service is given on the loch throughout the year.

* * *

Before the existing railway groups were formed, passengers in Scotland were allowed only 120 lb. of personal luggage free when travelling first-class, and 60 lb. third-class. These allowances have been increased to 150 lb. and 100 lb. respectively, to bring the Scottish area into line with the position in England.

* * *

Holiday-makers and others have for some time found it convenient to forward their luggage in advance under the luggage-in-advance arrangement, and they will be

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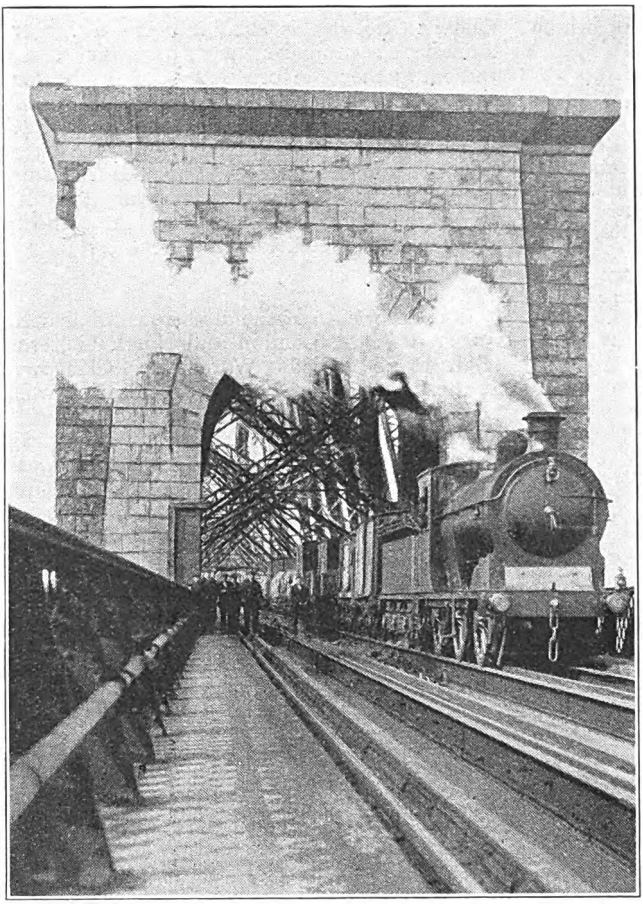

Photo.] [*Leslie J. Thompson.*

CROSSING THE FORTH BRIDGE.

L.N.E.R. Up goods train.
North British 0-6-0 locomotive No. 339.

pleased to learn that this facility on Scottish railways is likely to be extended in the near future to include the collection of such luggage for all parts of Great Britain at a slightly increased charge. At the present time luggage under this arrangement on Scottish lines is only accepted for conveyance and delivery in Scotland.

* * *

THE British Fleet visits the Firth of Forth from time to time, and in the month of October, when a number of vessels from the First Battle Squadron and the Battle Cruiser Squadron visited Rosyth, about 20,000 officers and men belonging to the Fleet travelled by the London and North Eastern Railway's line between the naval base and Edinburgh (Waverley).

AN innovation at Edinburgh (Waverley) station is a store specially constructed for the accommodation of bicycles only. The store, which is a loft in the cloak room, is capable of holding 146 bicycles in separate racks, and is so constructed as to avoid all possibility of damage or even of bicycles getting in contact with each other. When it is realised that prior to this arrangement being introduced about 150 bicycles on occasions were huddled together at one time in the ordinary cloak room, it will be readily understood that the staff had extreme difficulty in locating any particular bicycle when applied for by the owner. The frequent favourable comments made by the travelling public is an indication that the new arrangement is appreciated.

* * *

A NEW feature in connection with railway parcel traffic has been inaugurated in Edinburgh, Glasgow and other important Scottish towns, viz., the free collection of parcels for conveyance by passenger train. Previously to the grouping of railways parcels traffic in Scotland was not collected, or, alternatively, a charge was exacted if such a service was rendered.

* * *

SINCE the beginning of 1923 changes have been taking place in the appearance of Scottish engines and passenger vehicles. The old North British colours of olive green for passenger engines is giving place to the light green of the London and North Eastern Railway, and the crimson lake colour used for the carriages is being replaced by teak. The new colours are clean and attractive in appearance.

* * *

IT has long been the policy of the lines in Scotland, which now form part of the London and North Eastern Railway, to give the very best and most suitable train services for whatever class of traffic offered. This policy is maintained under the new order, and new through services are constantly being added, making long-journey travelling a pleasure instead of the tiring experience it

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was formerly. Some of the new long-distance through services are :—

Aberdeen and Bath and Bristol.
Aberdeen and Oxford.
Aberdeen and Penzance.
Aberdeen and Plymouth.
Glasgow and Edinburgh and Harwich.
Glasgow and Edinburgh and Penzance;
Glasgow and Edinburgh and Plymouth.
Glasgow and Edinburgh and Torquay.

* * *

RESTAURANT cars equipped to meet all requirements continue to be a feature in many of the Scottish services, and those running between Edinburgh and Glasgow, Edinburgh and Aberdeen, and Edinburgh and London, are fully taken advantage of by the busy business men, as well as by tourists and other travellers. The sleeping cars on the East Coast services are the latest pattern, new and greatly-improved coaches having recently been added to the stock. A new twin car has been running during the summer months between Aberdeen and King's Cross, while other cars of the same type are now running between other points in Scotland and London, and the new vehicles have elicited the highest praise from those who have used them.

* * *

SUBURBAN services are vastly important in these days of acute tram and 'bus competition, and the London and North Eastern Railway in Scotland is keenly alive to the need there is for making these services as attractive as possible. With this object in view, several new trains have been placed on the suburban routes in the neighbourhood of Edinburgh and Glasgow, these being electrically lit and steam-heated, improvements which have been welcomed by the public in these dark, cold, wintry days.

* * *

IT was the practice of the old North British Railway, when season tickets were issued, to exact a deposit fee of 5s. as a guarantee that the tickets would be returned to the company after the date of expiry. If the ticket was not renewed, the deposit fee was returned. The deposit charge has now been abandoned, thus bringing the railways of the Southern Scottish area into line with other railways forming the group.

* * *

A SYSTEM of zone or cheap weekly season tickets embracing certain areas and stations round about large towns, such as Glasgow and Edinburgh, is in operation on the Southern Scottish area of the London and North Eastern Railway, and is used largely. These tickets allow the passengers to travel as often as they please during the week between the stations which are included in the particular zone or area.

* * *

ON the London and South Western Section of the Southern Railway numbers are placed on the head-code discs to show the " duty " number of each engine. The use of the head-code discs obviates the necessity for special boards, as each engine carries its own number disc from the time it starts work until its return to shed, and no other provision has to be made. Its number may, therefore, apply for several journeys, including light, empty and up and down short-distance or long-distance passenger or goods turns, or during shunting service. To meet the needs of unusual traffic working, special boards may still be necessary, but probably to a lesser extent.

* * *

TWENTY new three-cylinder compound 4–4–0 locomotives are under construction at Derby. They will correspond generally with the present 1,000 class, but will have 19¾ in. and 21¾ in. cylinders and 6 ft. 9 in. coupled wheels instead of 19 in. and 21 in. cylinders and 7 ft. wheels. They will, of course, be fitted with superheating apparatus.

* * *

SEVERAL London and North Western locomotives, including " Precursor," " George V," and " Prince of Wales " class engines, have had their cabs narrowed to permit of their use on the Midland Division. Among engines so treated, Mr. G. Lowrie-Fairs specifies Nos. 837, *Friar*, and 1433, *Faerie Queene*, " Precursor " class ; Nos. 228, *E. Nettlefold*, 363, *Llandudno*, and 2242, *Meteor*, of the " George V " class ; and Nos. 122, *King of the Belgians*, 388, 812, 1132, *Scott*, 1321, *William Cowper*, and 1341. He also refers to the fact that Midland 4–4–0 engine No. 353 is stationed at Edge Hill shed, Liverpool, for working the through train to Derby and Nottingham, and that an old London and North Western 4–4–0 tank engine is located at Edge Hill for shunting purposes.

* * *

SUPPLEMENTARY to the information given on page 469, December, 1923, RAILWAY MAGAZINE, concerning the 0–8–4 tank engines recently constructed at Crewe having a " Detroit " displacement lubrication for cylinder lubrication and a mechanical pump for the lubrication of the journals, it may be mentioned that these engines are fitted with Wakefield mechanical lubricators for axleboxes.

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WRITING from Crewe, Mr. C. Williams reports :—

Nos. 7953-4-5 are the latest 0-8-4 shunting tanks to be put into traffic. They are stationed at Abergavenny, where also are the rest of the type. Of the remaining four, all of which are now in the paint shop, one, No. 7957, recently appeared in a white shade and with wording on one of the side tanks to the effect that it was the 5,639th engine built at Crewe.

No. 1967 "Cressy" (Alfred the Great class compound) has been converted to Renown class (two-cylinder simple).

In connection with the new livery, it is understood that the letters "L.M.S." are to be discontinued and replaced by the new coat of arms. Already several engines belonging to the Midland section, including the 4-2-2 single No. 600, have been so dealt with.

Nos. 1211 "John Ramsbottom" and 1682 "Novelty," 6 ft. 6 in. 2-4-0 passenger engines, have been painted red and renumbered 5012 and 5036 respectively.

Two ex-Wirral Railway locomotives have been broken up at Crewe, viz., No. 8 (0-4-4T) and No. 13 (0-6-4T). The Wirral section is now being worked by London and North Western engines of the 2-4-0 type with 4 ft. 6 in. wheels, which formerly were located at Buxton.

Several Claughtons are now running with new one-piece cast-iron chimneys of similar design to the built-up ones, including Nos. 149, 499 and 2373.

* * *

IN addition to the South Eastern and Chatham Railway locomotive mentioned last month, 4-4-0 No. 685 is now running in the new colours. The lettering and numerals on the tender are—

SOUTHERN
A
685.

As the South Eastern and Chatham section passenger coaches recently repainted green have a big A painted on the ends, apparently this letter is to be used to distinguish South Eastern and Chatham rolling-stock of the Southern Railway. The numerals "1" and "3" are not adopted to distinguish the class of the green-painted coaches, the words "First" and "Third" being employed.

* * *

A NEW ZEALAND reader, Mr. N. Blake, sends particulars of the finding of the Royal Commission appointed by the New Zealand Government to investigate the accident to the recent Main Trunk express at Ongarue. The Commission makes certain recommendations, but only with the idea of minimising results in the event of another disaster. No blame is placed upon anyone; neither is it considered that any steps which might have been taken would have made the situation more favourable.

* * *

RAILWAY model-makers and their requirements are the special care of Messrs. Edwards Brothers, Fairoak Road, Roath Park, Cardiff. We have received and perused with much interest the firm's list, which includes full-size outline drawings for model railway rolling stock and sets of parts for building open goods wagons, vans and brakes, and passenger train sets. The firm's latest catalogue of "blue prints" should be in the hands of every railway model enthusiast. RAILWAY MAGAZINE readers should write to the firm and enclose 2d. stamp for full particulars.

* * *

FOLLOWING the mishap on the extension works of the City and South London Railway on the evening of November 27 last, many alarming and misleading reports were in circulation. The real facts were that the excavation works came in contact with what is probably an old storage well. This caused an inrush of sand and water into the tunnel, leaving a crater-like empty space beneath the surface of the road. Being thus robbed of their support, the various mains and cables for gas, water and post office, &c., collapsed into the opening. The gas main did not explode. It broke by reason of its unsupported weight, and forming an explosive mixture with the air contained in the space void of soil. The gas became ignited. The hole in the ground was, therefore, the cause and not the result of the explosion, and was in no way affected by the gas burning from the fracture in the main before it could be plugged. The accident was in every way an exceptional one, and the company's engineers, who have had a very wide experience, desire to assure the public that nothing need shake its faith, either in the security of tube railways or of gas mains, both of which now form an essential part of those modern conveniences enjoyed so widely and performing such necessary functions.

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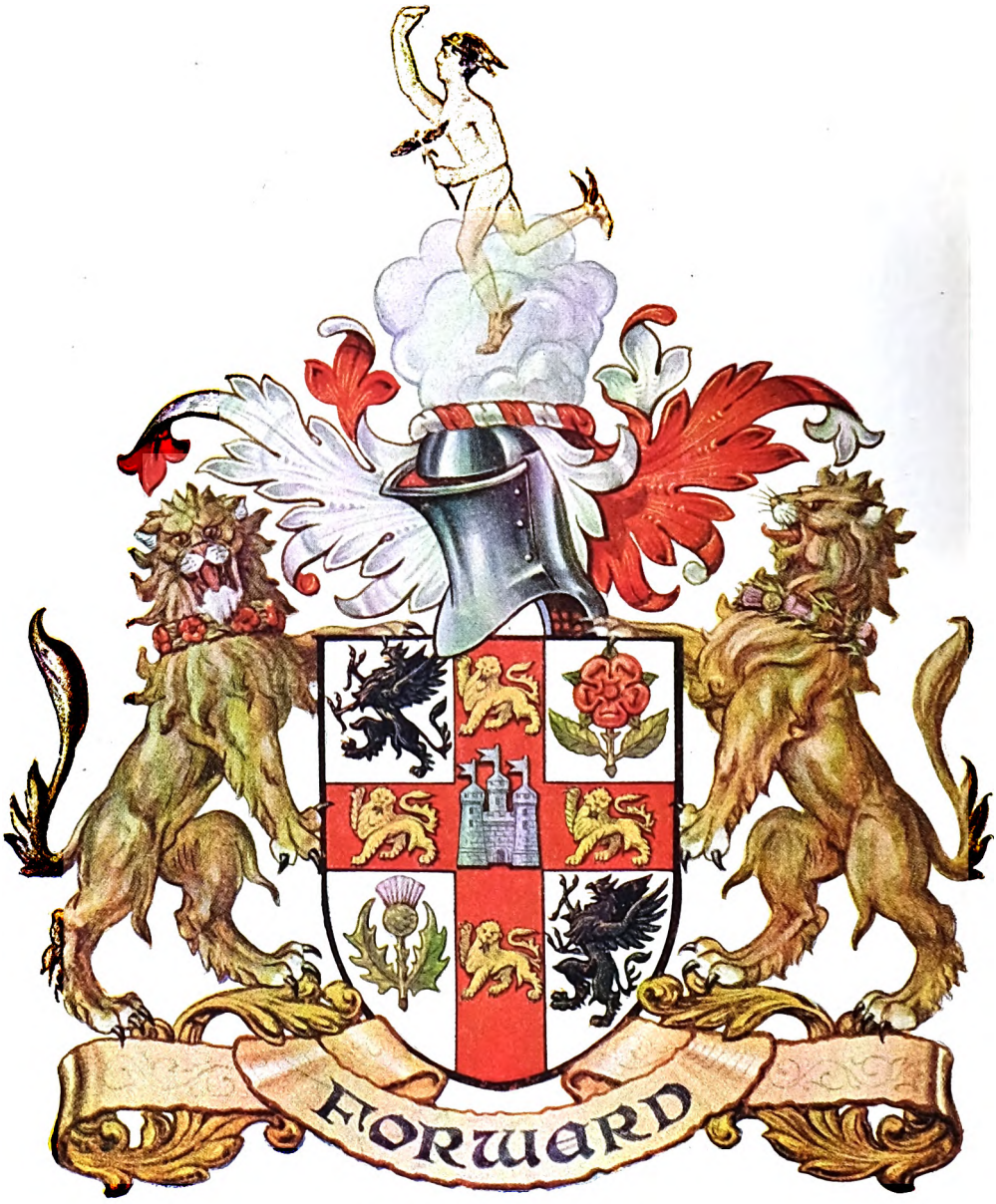

COAT OF ARMS
LONDON AND NORTH EASTERN RAILWAY.

Argent on a Cross Gules between in the first and fourth quarters a Griffin segreant Sable in the second a Rose of the second leaved and slipped proper and in the third quarter a Thistle also leaved and slipped proper the Castle of Edinburgh proper between four Lions passant guardant Or And for the Crest On a Wreath of the Colours Issuant from Clouds of Steam the figure of Mercury proper.

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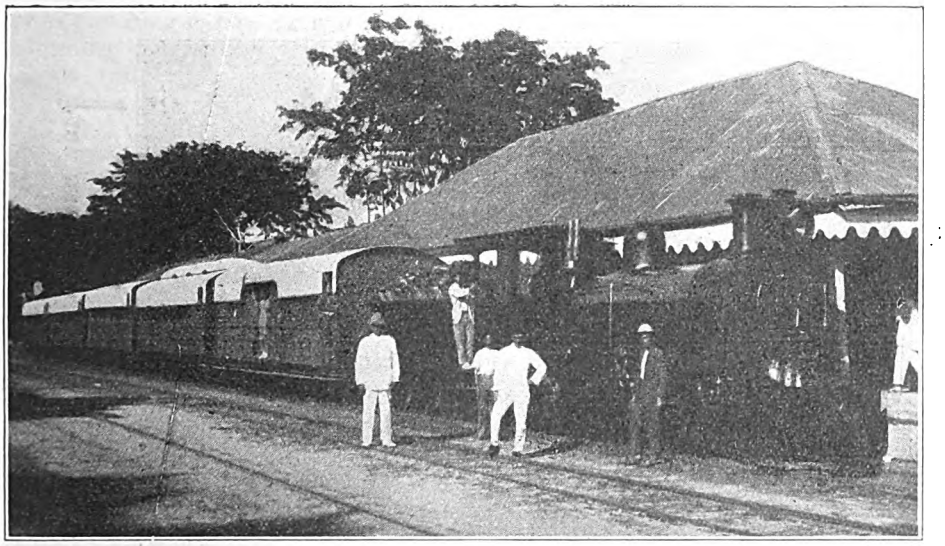

MAIL TRAIN AT JESSELTON.

The State Railways of British North Borneo.

By H. S. LAWRENCE.

BRITISH North Borneo is the northernmost part of the island of Borneo, and is separated from Sarawak by the state of Brunei. It belongs to the Sultan of Sulu, who lives on an island of that name situate near the Philippines. He has leased it to the Chartered Company, who control all the interests, paying a fixed sum annually for the concession. The company is under British protection, and is controlled by a Governor, assisted by Residents in the different districts.

The country is picturesque, mountainous and well wooded, and has a plentiful supply of waterways. The two principal towns are Jesselton, the headquarters of the Government, and Sandakan, the port. Construction of the State railways commenced in 1898, and was completed in 1906, the metre gauge being used.

They originally ran from Jesselton to Beaufort (57 miles), with branches from there to Tenom (30 miles), and Weston (20 miles). In 1910 the Tenom branch was extended to Melalap (9 miles). The main line was contracted for by Messrs. Pauling & Co., but the branch lines were constructed departmentally.

Thirty-seven bridges (of which more later) had to be built to cross the various rivers. These were originally constructed of timber, but have since been replaced by steel and concrete. The line is single all over the system, except at certain stations. There are no signals and no block system.

There are eight European officers (General Manager, Accountant, Traffic Supt., Loco Supt. and Assistant, Engineer-in-Charge, and two sectional engineers), and 550 Asiatic employees (320 Chinese, 200 natives, *i.e.*, Muruts, Dusuns, Malays, 30 Indians and Pathans).

During the year 1921 about 328,500 passengers were conveyed of all classes, 90 per cent. being third class. Cheap tickets are issued for teams of coolies and

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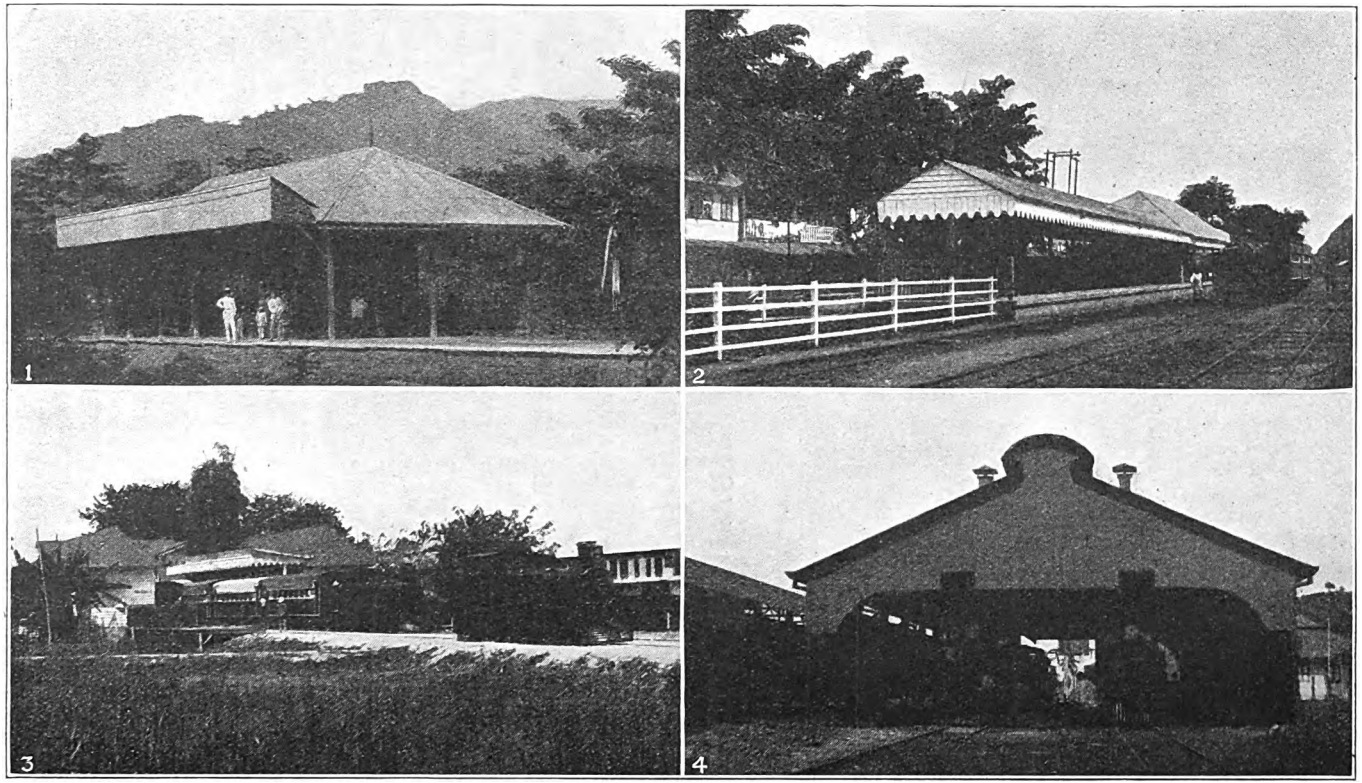

1. TENOM STATION.
2. JESSELTON STATION.
3. BEAUFORT STATION.
4. LOCOMOTIVE SHED AT TANJONG ARU.

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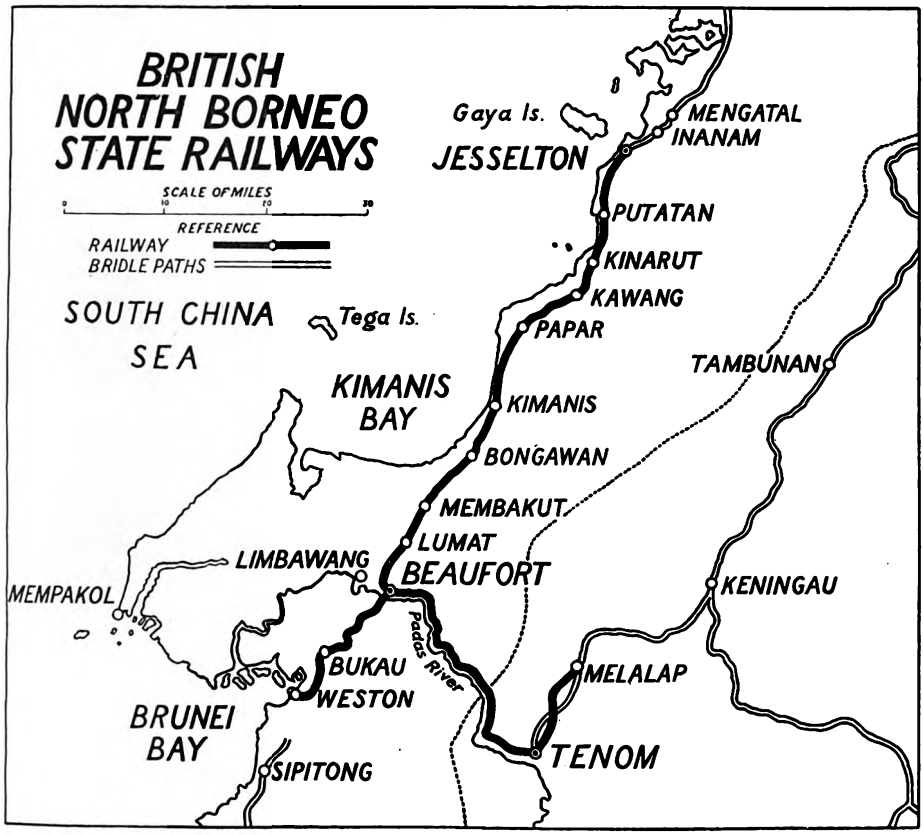
school children, together with passes for a limited number of journeys, the conductor punching a hole each journey till the number is completed.

Goods traffic consists of parcels (600 tons) and goods (rubber, timber, sago, rice (20,000 tons). All along the route are rubber estates at varying distances, and branch lines connect with the main. All the planters are provided with motor trolleys to take them to and fro, and the rubber is brought down on hand-propelled trolleys.



From Jesselton the line passes Victoria barracks, where the Sikh, Pathan and Murut soldiers are domiciled; Tanjang Aru, where are the carriage and repairing shops; and Papar, whose platform becomes a fruit market upon the arrival of a train, mangusteens, pineapples, mangoes, durians, etc., being offered at ridiculous prices. Just before reaching the last-named station a disused line to the left may be seen. It is the old route, abandoned in favour of the present cutting, owing to the incline to be negotiated, difficult at any time, almost impossible during the rains. The *modus operandi* was to keep charging the hill till the top was reached. En route, on either side, jungle, rubber plantations and water paddy are met with, and to the newcomer the sight of buffaloes ploughing land which is 2 ft. under water is interesting.

Beaufort is a small settlement charmingly situated amongst the hills, and the bungalows built amongst the luxurious foliage make a very pretty picture. Two branch lines are in operation from Beaufort, to Tenom and Weston. To use the latter it is necessary to cross the Padas river for the south station. Its sphere of usefulness is confined to carrying goods and passengers to connect with the motor launch which runs between Weston and Labuan.

The 30-mile ride from Beaufort to

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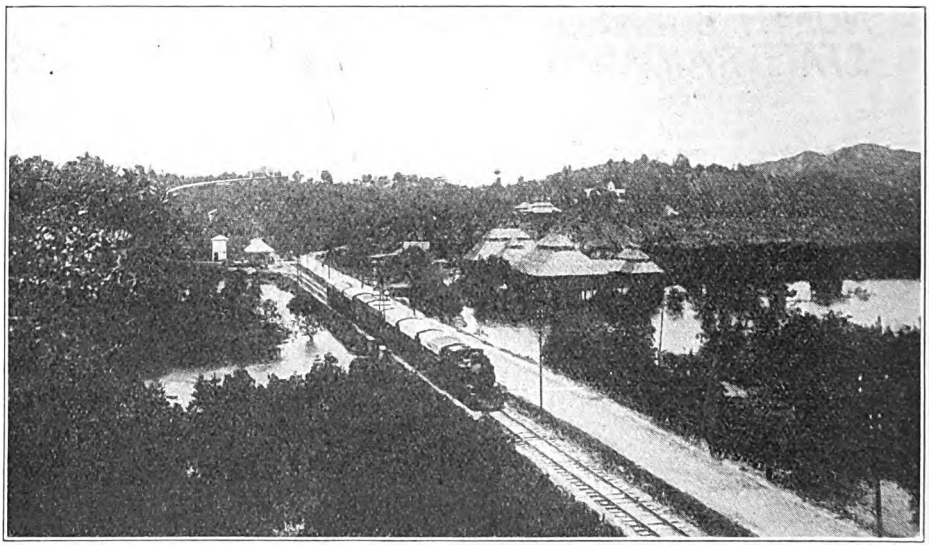
Tenom is full of interest, as it passes through the famous Sungei Padas Gorge. The route follows the sinuous course of the Padas river. On either side wooded hills rise to 3,000 and 4,000 ft., and if a sharp look-out is kept crocodiles can be seen basking in the sun. During the landas (rainy season) the line suffers severely from the rising of the river and landslips from the mountain, necessitating ceaseless vigilance. Some section of the line is constantly under repair, and the consequent upkeep is very heavy.

The train service between Jesselton and Beaufort consists of one train each way daily, with an extra on Tuesday, Thursday and Saturday. On Sunday there are two each way. All trains are of the stopping variety, and the time occupied is 3 hours 47 min. to 4 hours 25 min. Between Beaufort, Tenom and Melalap there is one train each way on alternate days, 3 hours 35 min. being the usual time. Between Beaufort and Weston



MAIL TRAIN LEAVING KARAMUNSING.

Tenom, 700 ft. above sea level, is smaller than Beaufort, but just as pretty, being laid out on a similar plan. It is the headquarters of the Resident of the interior, who has a very large tract under his control. The gradients from Jesselton to Tenom range from 1 in 44 to 1 in 86. The sharpest curve is 4 chains.

The bridges, already referred to, are a feature of the line. The principal is that which crosses the Papar river, which has four 100-ft. spans. The steel superstructure is carried on ten cylinders, 7 ft. in diameter, put down in pairs. The overall length of the longest cylinder is 74 ft. The cylinders are from 30 to 50 ft. in the ground. Other bridges include 22 of 20 ft. clear span, three of 50 ft., six of 60 ft., one of 80 ft., three of 130 ft. The bed of the line is stone, and the rails are 60 lb. to the foot.

two trains each way daily are provided. A local service is also in operation between Jesselton and Tanjong Aru. These trains (nine each way daily) stop at halts located near the residences of various Government officers.

The services mentioned do not appear very generous, but are ample for the traffic. They can be supplemented by rail motors, which are kept at certain places and may be hired at reasonable prices. The trains are made up of corridor stock for all classes, with lavatory accommodation in the first and second. On the outward journey tiffin can be ordered at Papar, and will be brought on the train at Beaufort, tea boxes being supplied on the return journey.

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The rolling-stock is quite up to date and is as follows :—

ENGINES, 15.
4 tank 0-4-2.
4 tank 4-6-4.
2 tank 0-6-4.
5 tender 4-6-0.

COACHES AND TRUCKS.
26 bogie coaches.
10 four-wheel coaches.
4 goods (bogie) vans.
201 other goods vehicles.

The 4-6-4 tanks have 11 in. × 18 in. outside cylinders, 6 coupled driving wheels, 3 ft. 6½ in. diam., water capacity, 800 gallons; wood fuel capacity, 5½ cub. yd.; pressure, 180 lb. per square inch; weight, loaded, 33 tons. They have steam and hand brakes, but not a continuous brake. Cow-catchers (very necessary as cattle are constantly straying on the permanent way) and headlamps of the American pattern are also provided. The tank engines were all constructed by the Hunslet Engine Company. The tender engines, which came from Kerr, Stuart & Co., have 11 in. by 18 in. cylinders; water capacity, 1,000 gallons; wood capacity, 5½ cub. yd.; pressure, 175 lb. per sq. in.; wheels, 2 ft. 6 in. diam.; weight, loaded, 34¾ tons. Three smaller tank engines are stationed at Tanjong Aru, Weston and Tenom. They have 9 in. by 16 in. cylinders, 2 ft. 6 in. coupled wheels, weight, 16 tons.

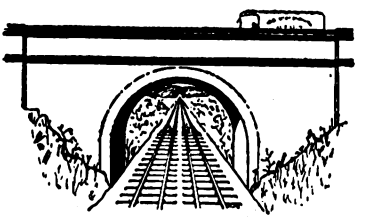
The passenger coaches comprise composite third and first class and combined first and second class. They are 30 ft. long, with an internal width of 7 ft. The framework is constructed of mirabau, the next hardest wood to bilian and much employed for making furniture in the Far East on account of its capacity for resisting weather and white ants. It takes a beautiful polish, which also adds to its popularity. The interior is made of Selangor batu, another very durable timber which grows in the Tenom Gorge.

The coaches are not painted, and with a covering of double duck look very smart. They are carried on four-wheeled bogie trucks and weigh 12 tons. Their bases are those of the original rolling-stock made in England by Kerr, Stuart & Co., with certain alterations and modifications. The superstructures have all been made in the local shops.

The first-class cars are fitted with rotan settees, swivel chairs and tables. They have glass windows and lattice shutters. The average life is seven to eight years. For the use of H.E. the Governor and any distinguished visitor a special observation coach has been constructed locally, which is a model of elegance and luxury. It is 38 ft. long over the frame and 4 ft. over the buffers. There is a verandah at each end, 6 ft. 8 in. inside. It is always attached to the end of the train. The interior is made of tomasok, a very rare hard wood similar to box and only found on the west coast of British North Borneo. In all sixteen different kinds of timber have been employed to show the utility and beauty of local wood. The carved brass work was all cast in the local shops. The fittings include rotan chairs and settees, dining and card tables, and a large ice chest. The cost was $16,000, which is a quarter of what the bill would have been had it been made in England.

The carriage works and fitting shops at Tanjong Aru, already mentioned, were erected in 1915, and cover 20 acres. They consist of erecting, machine boiler shops and smithy. In addition to constructing coaches they undertake all the fitting and repairs, the construction of boiler plates, the renewal of tyres The most up-to-date machinery is employed including a powerful hydraulic press.

The company has a very fine hotel in Jesselton and comfortable rest-houses at Beaufort and Tenom. It also possesses a fleet of six Ford motor-cars.



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The Birmingham Railway Problem.

A SUGGESTED SOLUTION.

By C. B. HARLEY.

While in no way endorsing the author's opinions, or suggesting to what extent, if at all, the proposed new works, reconstructions, and other changes are practicable, or likely to be adopted by the London Midland & Scottish Railway, which is principally concerned, many of the ideas advanced possess considerable interest. It is by no means improbable, we are given to understand, that certain of the Bays at New Street Station will be joined up in order to improve the working of traffic, while the inclusion of the London & North Western and Midland systems in the London Midland & Scottish Railway opens the way for important developments in through working and for relieving congested points.—[*Ed.* R.M.]

ALTHOUGH it has to accommodate more than half of the railway traffic centring upon the City of Birmingham, and deals with the traffic of both the English Divisions of the London Midland & Scottish Railway, New Street Station* is in many respects inconvenient for the working of the tremendous volume of traffic with which it has to deal. A principal reason for this is the fact that the rail approaches in all directions are very much congested, though the lay-out of the station, developed from early days and in stages, is also a contributory factor.

Between Proof House Junction and the east end of the station, a distance of approximately 500 yards, four sets of metals are laid. Two of these carry all Western Division traffic to and from London and the south, all local trains to and from Coventry and Leamington, the heavy Four Oaks and Lichfield suburban service, Walsall trains running via Witton, in addition to empty coaching traffic between Vauxhall carriage sidings and New Street, and certain light engine workings to and from Aston running sheds. The other two lines convey all Midland Division expresses between Derby and Bristol, the Leicester traffic, the Sutton Coldfield and Walsall suburban trains, the service to and from King's Norton and beyond via Camp Hill, and empty coaching trains and light engines to and from their respective depots at Saltley, two miles out towards Derby. Before diverging into the "old" and "new" parts of the station, the two pairs of lines are connected by two double crossover roads, the right-handed one, which does not appear to be used, being situate a few yards west of Proof House Junction, and the left-handed one adjacent to the two signal boxes controlling the station entrance at the east end. The lines are of course arranged alternately "up" and "down," London and North Western on the north and Midland on the south side.

At the east end of the station the platforms and their running lines are carried up very near to the tunnel mouth where the two companies' metals converge; especially is this so in the "old" part, used by London and North Western trains; consequently shunting movements from one platform to another inevitably foul the sole exit for trains ready to leave in this direction.

A further complication is introduced by the fact that when Western Division trains draw out from a platform to set back on to another line, the engine is usually in the tunnel some little way down a steep incline, so that not only does signalling to the enginemen become a matter of difficulty, but owing to the greasy state of the rails, setting back a heavy load occupies an inconveniently long time, due to slipping.

Again, there is very little accommodation on the spot for the disposal of coaches not required for the moment, and what little there is, namely, a few reception roads between the platforms, is so fully occupied that light engine movements from one end of the station to the other have to be made along the platform lines, thus diminishing seriously the time during

* See *Railway Magazine*, November, 1915.

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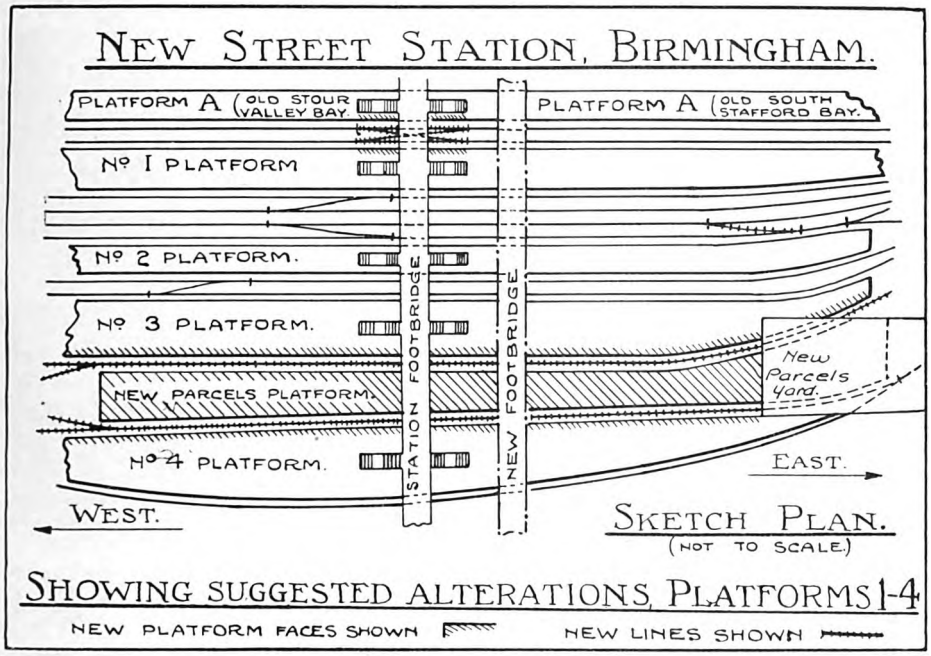
which the platform faces are available for their proper use.

Readers are no doubt familiar with the plan of New Street station, which was described in the RAILWAY MAGAZINE for November, 1915, by Mr. J. F. Gairns.

Briefly to recapitulate its main features, it is shaped like an elongated D, the straight stroke representing the London and North Western (or "old") block of three platforms, Nos. 1, 2 and 3, and the curved the Midland (or "new") block consisting of Nos. 4, 5 and 6 platforms. Between the two there runs an inclined carriage way known as Queen's Drive,



from entrances above the station at either end, dipping in the middle to platform level. The old block contains four long platform faces, with six short bays, and two long reception lines for empty stock between Nos. 1 and 2 platforms. The new block contains also four long platform faces, but only one bay, and there are also two long reception lines, one between Nos. 4 and 5 and the other between Nos. 5 and 6 platforms.

It is understood that shortly before the war a scheme of improvement was under consideration which included the joining up, on No. 1 platform, of the double-line South Stafford bay, facing east, with the similar Stour Valley bay facing west, the two sets of buffer stops being separated by only a short length of platform which could easily be removed. This would convert No. 1 into an island platform, and at the same time provide a new very long platform on its northern side, and the two new through roads would diminish the amount of shunting at present necessary.

Another improvement suggested at that time was the making of New Street a "closed" station by the provision of an additional footbridge, not communicating with the platforms, stretching right across the company's property from Stephenson Place on the north to Station Street on the south, for the benefit of people going about their business in the city. The existing station footbridge is at present used more by non-passengers than by those requiring to travel; in fact it is one of Birmingham's principal thoroughfares. None of these alterations has been carried out as yet, and it is submitted by the present writer that alterations on a bigger scale still would prove advisable.

Let it, however, be said that the suggestions contained in this article are put forward with all diffidence and in no

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critical spirit but, rather, one of anticipation.

The problem is twofold, having both an engineering and a traffic aspect, and it seems that only by considering the two simultaneously can we arrive at a practical solution which will simplify the punctual and economical working of an increasing volume of traffic, by bringing more platform faces into use as well as by relieving the station of some of its exchange traffic.

From the engineering standpoint, the possibility of widening the approaches either east or west has been ruled out on account of the cost, the line being in tunnels most of the way. But, assuming the alterations in the lay-out previously described to have been made, the writer's additional suggestion is to abolish Queen's Drive as a thoroughfare and to lead a single line of rails round the outside of both No. 3 and No. 4 platforms, the existing parcels dock and another bay line on No. 3 being removed. These would then become island platforms of considerable width, and between the two new lines an additional island platform should be built exclusively for parcels traffic, the goods being lowered to it by lifts from a new high-level parcels yard extended from the Worcester Street frontage some little distance back into the station area, covering the east end of the new parcels platform, which should be cut short at the west end to allow of a scissors crossing being laid to connect the running lines on either side of it. At this (west) end also, by retaining a short piece of Queen's Drive, or better still, if possible, by bridging over the acute angle made by the junction of Navigation Street with Hill Street, an additional frontage for passengers and luggage would be provided, giving direct access to Nos. 3 and 4 platforms by means of stairs or lifts. Further, one of the reception lines between Nos. 1 and 2 platforms, that nearer to No. 2, should be reserved for light engine movements, the connections with the platform line being rearranged so as to permit a tank-engine to "run round" a long train on No. 2 (north face) without fouling other traffic, this platform face then being reserved as far as possible for the Four Oaks slow trains, which are made up to eight or sometimes 12 bogies. At present these trains arrive from Four Oaks on No. 2, from the east, and after unloading their passengers either load up again almost immediately for Four Oaks or else proceed empty to Vauxhall off the same platform, but the interval between arrival and departure is rarely, if ever, sufficient for the incoming engine to hook off, run round the train, and couple up at the other end, since the running round has to take place past No. 1 platform, which may be continuously occupied at that period. Consequently a fresh engine has to be provided to work the train out, and the incoming engine waits in the station for perhaps an hour, until the next convenient departure to Four Oaks, this service being treated as an independent unit as far as locomotive power is concerned. By keeping a running round line free the company would be enabled to make much more economical use of water, fuel and enginemen's time, and though a line for this purpose cannot at present be spared, the provision of additional platform faces would render the problem of storing empty coaches less acute.

Although forming but one of the many suburban services worked in the Birmingham district, the Four Oaks trains are of considerable importance both on account of their number and seating capacity. The time-tables provide about 30 trains in each direction, and the seating capacity of the standard eight-coach sets is about 500 passengers.

On the present Midland side of the station the additional face to No. 4 platform would be valuable, and although west-bound trains which use No. 6 and one face of No. 5 platform would be under the same disadvantages as at present, it is suggested that by a re-arrangement of the traffic, introducing at least two expresses in each direction between Derby and Bristol which avoided New Street, the congestion would be relieved and the facilities, if reduced in quantity, would be improved in quality.

In dealing with the traffic aspect of the problem the writer has endeavoured to keep before him the following points:—

(1) Separation of holiday traffic from business traffic over the same route.

(2) Extended use of cross-country through trains, minimising waste of passengers' and railwaymen's time awaiting connections at junctions.

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(3) Provision of a few through services in summer from populous suburbs over well-defined holiday routes, relieving transfer and congestion at the main city station.

(4) Signalling has two functions: one is to stop trains; the other, to keep them moving.

(5) Where traffic does not exist, facilities create it.

Now although the traffic at New Street station is wonderfully well operated considering the difficulties which are presented to the staff, the station is normally worked up to its full capacity and is unfitted to cope with seasonal increases of traffic. Whilst grounds for dissatisfaction on the passenger's part are commendably few, there are two important ones, namely, the liability at all times of the London and North Western suburban service to cumulative delay; and the disadvantage at which Birmingham is placed by the Midland Division in being treated merely as an intermediate calling place on long-distance expresses, which arrive with their limited seating capacity already comfortably full of passengers who are not getting out. The platform extensions previously mentioned would probably afford the necessary relief in the first case; with regard to the second, it is suggested that if a few of the West of England expresses between Derby and Bristol carried no Birmingham traffic whatever, they would still, at all times of the year, convey paying loads, and not only would the long-distance travellers obtain a quicker and less crowded journey, but Birmingham passengers, if given the benefit of a few new end-to-end services to compensate for the facilities withdrawn, would travel in much greater comfort.

Here, again, in order to minimise shunting at New Street, a Midland Division express from Bristol terminating at Birmingham might arrive and unload its passengers on No. 4 platform as at present, and leave again off the same line ten or fifteen minutes later for Euston, crossing over to Western Division metals at the east end of the station just as the Bournemouth to Manchester train does now. (It is assumed that the amalgamation of the two systems will result in rolling-stock being pooled. Similarly an express from Liverpool (Lime Street) to Birmingham might, shortly after its arrival, become an express from Birmingham to Sheffield and Leeds, being dealt with on No. 1 platform and crossing to

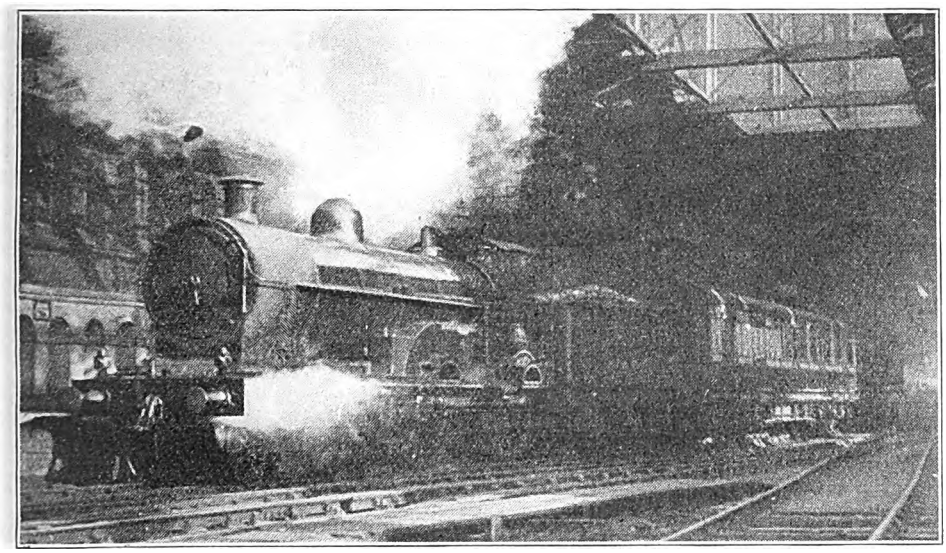

Photo.] [*Henry L. Salmon.*

EUSTON-WOLVERHAMPTON LUNCHEON-CAR EXPRESS LEAVING NEW STREET STATION.

London & North Western 4-4-0 locomotive No. 2081, "New Zealand."

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Midland metals just before reaching Proof House Junction. By co-ordinating originating and destination points so as to eliminate through traffic and make each part of the total journey a distinct end-to-end service, shunting would be unnecessary and stock would be economically used. The peculiar alignment of the railways here, which causes a Midland north-bound train to run parallel with and in the same direction as a London and North Western south-bound train, favours this method of working, although of course it would only be brought into use when the withdrawal to another route of an existing through train from Bristol to Leeds, or *vice versa*, left a gap in the service between Birmingham and those places. As far as the London and North Western system is concerned, Birmingham is, from a traffic point of view, already treated almost as a terminus; the Wolverhampton continuation of the Euston trains appears to be often justified solely from a locomotive and rolling-stock standpoint. It is possible that one two-hour service between Birmingham and Euston might profitably begin and end, not at Wolverhampton, but at Redditch on the Midland section.

We have now considered both the structural and the operating alterations at New Street station, and it remains to be seen whether a solution of the Birmingham problem may not be brought still nearer by other alterations in the suburban area. These will be considered in relation to the fusion of the two systems, but it happens that those here suggested chiefly concern existing Midland lines.

On the West Suburban section between Birmingham and King's Norton, which is a piece of the main route to Bristol, the first two stations out of New Street, Five Ways and Church Road, might be closed. They do very little traffic nowadays, and, for reasons beyond the company's control, are unlikely to do more in the future. The signal-boxes would, of course, be retained, and the inordinately long block section (for an urban area) of two miles, from Church Road Junction to Selly Oak, should be split up by the provision of an intermediate box at Somerset Road station, which would then become the first call for stopping trains after leaving New Street, the intervening distance being two miles. At present the signals here are normally "off," being put to danger by levers on the platform only

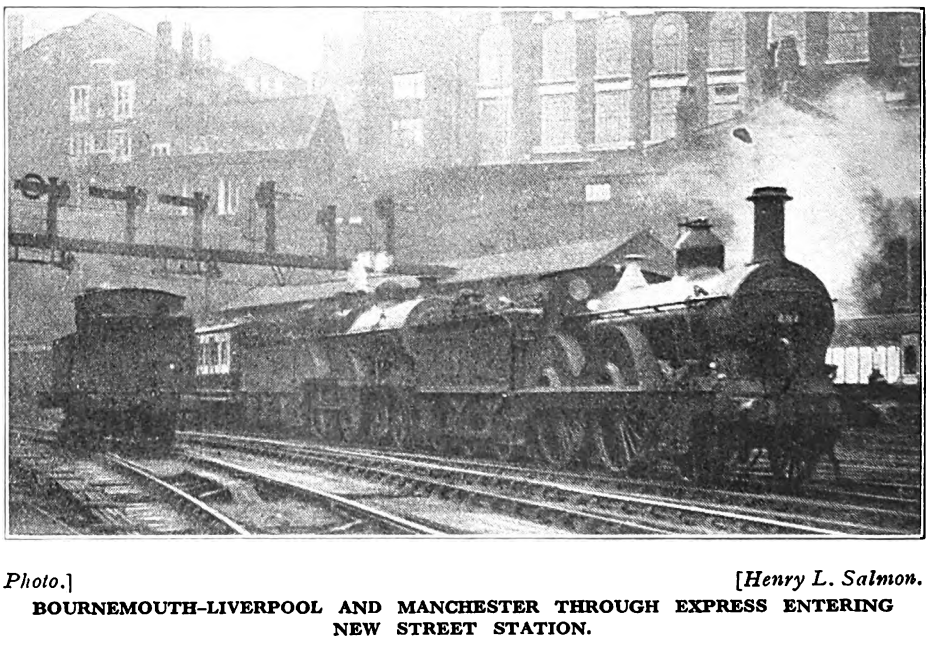

Photo.] [*Henry L. Salmon.*

BOURNEMOUTH-LIVERPOOL AND MANCHESTER THROUGH EXPRESS ENTERING NEW STREET STATION.

Midland locomotives Nos. 281 (2-4-0) and 510 (4-4-0).

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when a train is actually stopping in the station. The provision of an additional block post, together with the elimination of the calls at Five Ways and Church Road for local trains, would greatly increase the carrying capacity of the line, and the time spent on the inward journey from King's Norton to Birmingham by suburban passengers would be reduced from 25 to 18 mins. or less, with an equivalent reduction for the outward journey. Another advantage would be the possibility of increasing the number of goods trains in and out of the Central Depôt in Suffolk Street, reached by way of Church Road Junction. On the Walsall branch, which leaves the main line to Derby at Castle Bromwich North Junction, 5¼ miles from Birmingham, and runs thence via Penns and Sutton Coldfield into Staffordshire, the alterations suggested are the provision of (*a*) high-speed junctions at Castle Bromwich North, Water Orton South, and Park Lane Junction; and (*b*) a spur at Sutton Coldfield connecting this Midland branch with the London and North Western line from Birmingham to Four Oaks, Lichfield and Burton. With regard to (*a*) the term "high-speed junction" is intended to describe a lay-out which will permit a train to pass over it in any direction without reducing speed below, say, 40 m.p.h., such as the existing junctions at Kingsbury and Water Orton North, laid down about 1909. Considering (*b*) the situation of this spur is admittedly far from ideal. The Midland line to Walsall, running south-east to north-west up a gradient of 1 in 100, passes Sutton Coldfield station and almost immediately crosses over the London and North Western Railway, which is here running up a similar gradient, from south-west to north-east, gradually curving round to north-west. It is suggested that by constructing a double-line spur from the east end of Sutton Coldfield (Midland) station, upon its northern side, to join the partner railway's line between Sutton and Four Oaks, the two points to be connected would not show a great difference of level. The curve of the spur would be sharp, but not, it is thought, sharper than that at Ambergate, for instance, which station the new Sutton Coldfield would somewhat resemble, minus the west side of the triangle.

It will be as well to point out at this juncture that the Midland's Walsall branch, though it includes some long gradients, is double throughout and appears to be well laid and suitable for fast running. The service at present operated is meagre, except on Bank Holidays, consisting of about eleven passenger trains each way on weekdays, whilst the goods service is almost entirely of a "through" nature and is of no great volume. There should be no difficulty in finding the head room necessary to work an appreciable amount of extra traffic over this line.

Moreover, Sutton Coldfield, the chief intermediate station, serves a town of 20,000 inhabitants, which is not only a royal borough of considerable antiquity, mentioned in one of Shakespeare's plays, but is also a place of considerable charm, much favoured as a residence by Birmingham people. If it were not so near to the Black Country there is little doubt that Sutton would by now have rivalled Cheltenham as an inland health resort, for, though the scenery is not so fine, the air is very much more bracing, and the natural park, which lies to the west and provides a reservoir of pure air, which the prevailing winds carry over the town, offers a unique blend of typically English—one would almost say Shakespearean—scenery.

By means of the Sutton spur a third through route between Birmingham and Burton would be laid open. The present Midland line between these points is beautifully graded, but misses all the towns save Tamworth. The present London & North Western line takes in the important residential districts of Sutton Coldfield and Lichfield, and has business connections with the whole of the South Staffordshire coalfield and with Walsall, but, besides being heavily graded and passing through the Aston "bottleneck" near Birmingham, one of the busiest junctions in the district, it is provided only with a service of stopping trains, and their connections with the Midland expresses at Burton are not always conveniently arranged. Trains running between Birmingham and Burton via Penns and the new spur would, however, avoid Aston and yet serve Sutton and Lichfield. On the other hand, they

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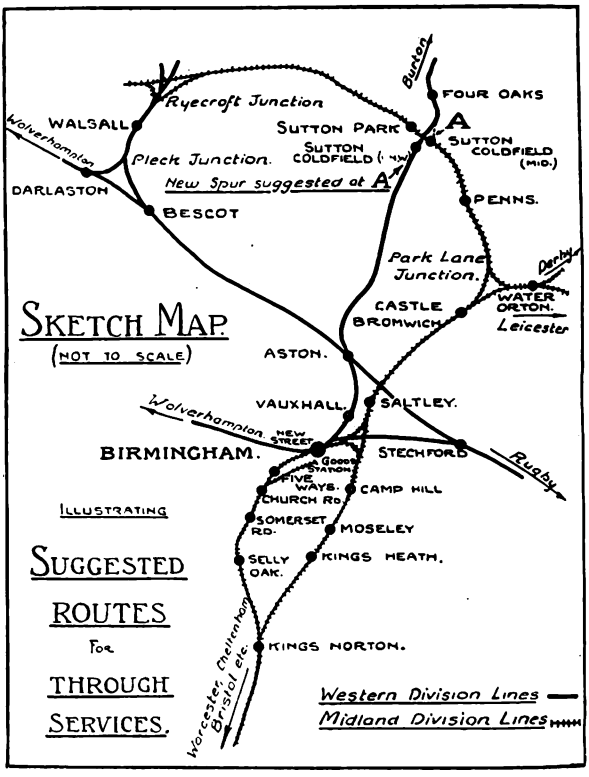
would be required to cover 2¾ miles' extra distance and to face a long and steep climb from Castle Bromwich to a point beyond Four Oaks, a bank nearly seven miles long. The route would, however, be suitable for Western Division fast trains between Lichfield and New Street, which do not stop between Sutton and Birmingham and rarely load to more than five bogies. These trains might well be increased in number at the expense of some of the slow ones, which show little improvement in point of speed over an excellent motor 'bus service which competes with them. Through traffic might be catered for by the present Midland 7.12* a.m. Worcester-York and 2.5* p.m. Bristol to Sheffield (8.45* a.m. and 4.25 p.m. respectively from New Street), and by the 7.50 a.m. Sheffield-Gloucester and 3.10 p.m. York to Worcester (9.27 a.m. and 6.22* p.m. out of Burton). With stops at Sutton and Lichfield the booking from Birmingham to Burton would be about 51 minutes, and in the opposite direction 52, an excess of only 7 minutes over the existing non-stop schedule via Tamworth. This town might be compensated for its loss of facilities by the insertion of stops in one or two other expresses, which now do not call, following the usual Midland route.



Another important business service would be rendered possible between Leicester and Stafford, a light corridor train being run via Water Orton South and Park Lane Junction to call at Sutton, Walsall and Wolverhampton. At Stafford the coaches should be attached to an express from Bradford and York to Swansea, running from Derby on to the London & North Western main line at Lichfield Trent Valley (a spur exists, which might need to be relaid for passenger traffic), and proceeding thence via Shrewsbury, Knighton and Llandilo. In time a regular holiday service would in all probability grow up between Yorkshire and the Midlands and the spas of Central Wales, which would call for a train to itself. Turning now to holiday services, it is suggested that the Manchester to Bournemouth, Bradford to Bournemouth, and Bradford to Torquay through trains should avoid New Street station altogether. In the first place, there are plenty of other good trains between the industrial towns named; in the second, the Birmingham and Bournemouth traffic, if concentrated into one daily train each way, would justify an end-to-end express, and, finally, the passengers from Birmingham to Torquay must eventually complete their journey over the Great Western Railway, who may be trusted to see that their own service from Snow Hill, Birmingham, is at least equal in point of speed to the Midland's from New Street, once the trains are west of Bristol.

There are, however, some large suburbs from which Snow Hill station is an inconvenient journey, and for the benefit of these it is suggested that the Bradford-Torquay train should run non-stop between Derby and King's Norton in both directions via Camp Hill. At King's Norton should

* September times.

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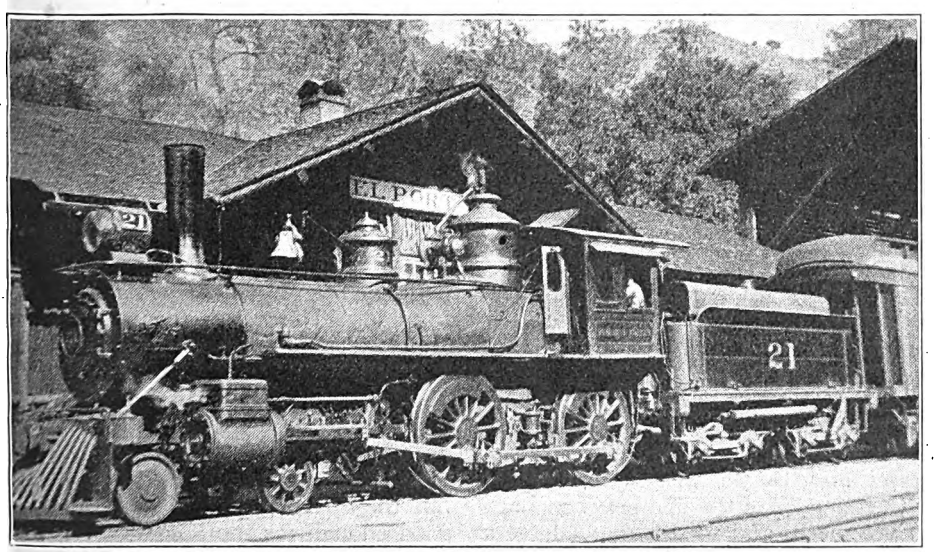
be attached or detached, as the case might be, two corridor coaches or more, worked as a separate train from and to Four Oaks via the new spur, calling at Sutton Coldfield, Moseley and King's Heath, and only available for through passengers.

The new Birmingham to Bournemouth express might also call at King's Norton to pick up, in connection with the ordinary local service, also calling to set down on the return journey, but omitting the stops at Cheltenham and Gloucester. The Bradford and York to Bournemouth train, relieved of all Birmingham traffic, might convey a Bristol portion as well, and run non-stop from Derby to Mangotsfield via Camp Hill. Passengers from Birmingham and the North of England for Cheltenham and Gloucester would still have a number of expresses to choose from, and would travel in greater comfort owing to their train being relieved of much traffic destined for the Great Western and Somerset and Dorset Joint Railways.

The Manchester (London Road) to Bournemouth express, conveying a through portion from Liverpool and leaving Crewe at, say, 10.45 a.m., would then stop at Wolverhampton to take up for Cheltenham and beyond (and incidentally to change engines), from 11.34 to 11.38, and run thence via Pleck Junction and Walsall (not to stop) on to Midland metals, calling conditionally at Sutton Coldfield, and proceeding via Castle Bromwich and Camp Hill to Cheltenham. The suggested passing times are: Walsall, 11.50; Castle Bromwich, 12.12; Bromsgrove, 12.40; the Cheltenham arrival being, as now, 1.13 p.m. These bookings admittedly demand a return to pre-war speeds on the Midland's West of England line, but this is surely not asking much.

Incidentally, the train would compete effectively with the Great Western expresses from Birkenhead and Wolverhampton, not only to Bournemouth, but to Cheltenham as well.

OLD AMERICAN LOCOMOTIVE STILL IN SERVICE.



We are indebted to Mr. Eric Crickmay for the photograph reproduced, taken by a friend of his, showing an old-fashioned American 4–4–0 locomotive still in use on the Yosemite Valley Railroad.

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Locomotive and Train Working in the latter part of the 19th Century.

SOMERSET AND DORSET JOINT RAILWAY [No. I.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

IT is not my intention to deal with the genesis and history of this railway, since those who are interested in this portion of the subject will find a full account in THE RAILWAY MAGAZINE for January and February, 1905, under the title of "Why the Somerset and Dorset became a Joint Railway," by Mr. Herbert A. Rake. Suffice it to say that the railway was an amalgamation in 1862 of the Somerset Central Railway, originally a broad (7 ft.) gauge line, and the Dorset Central Railway. The former ran from Burnham to Wells, and was subsequently, in 1861, extended from Glastonbury through Evercreech Junction to Cole. The Dorset Central Railway started at Wimborne, and joined the former line at Cole. A short time before the amalgamation of the two railways, the Somerset Central was converted to the "narrow," or standard gauge, much to the disgust of its neighbour, the Bristol and Exeter Railway, which always had designs on the smaller line. Most of the Somerset Central Railway is now a branch of the main line, which was opened in July, 1874, by means of a spur from Evercreech Junction through Radstock to Bath, where it joined the Midland Railway. After this, the railway between Bath and Wimborne became the main line, though the short section at the southern end between Bailey Gate and Wimborne was afterwards shorn of its importance by the much more recent opening of a new loop to Broadstone Junction, which enabled the trains from Bath to run direct to Bournmouth over the London and South Western Railway.

My first personal acquaintance with the Somerset and Dorset was made a week after the opening of the line between Bath and Evercreech, and to this day I have a most vivid recollection of journeys made over the line, at a time when I was a small boy. The old dark green engines were not much to look at, as far as appearance and somewhat diminutive size went, but when it came to running down banks of 1 in 50 at high speeds they were very much "all there." As they could do little more than crawl up one side of the bank, the drivers made amends by letting the engines out for all they were worth down the other side. Further, since the trains consisted of four-wheeled coaches, the age of which was extremely uncertain, the side-to-side motion was somewhat appalling, especially between Binegar and Evercreech Junction, where I more than once thought that my days were about to end. Moreover, the Company was then in a very bad financial condition, and the state of the rolling-stock and the older parts of the permanent way was, to put it mildly, extremely dubious.

The Midland and the London and South Western Railways took over the Somerset and Dorset Railway from November 1, 1875, but as their lease was for 999 years they had plenty of time in which to make much-needed improvements and being in no hurry, left things for a time pretty much as they were, until careless signalling brought about the Radstock disaster on August 7, 1876.

The line was "single" throughout except at passing stations, but single-line working requires some sort of adherence to punctuality if traffic is to be worked properly. Punctuality was not the strong point of the old Somerset and Dorset, far from it! There was, connecting with a Midland train from the north, a so-called "fast train," which was due to leave Bath about afternoon-tea time, and was supposed to reach Wimborne somewhere about supper-time.

I do not know the exact time-table times, but the above timing of the train is quite good enough for the Somerset and Dorset arrangements of that day, and if the train had only stuck to tea and supper times all would have been well. It managed the teatime start fairly well, but got out of hand at Evercreech, where something on

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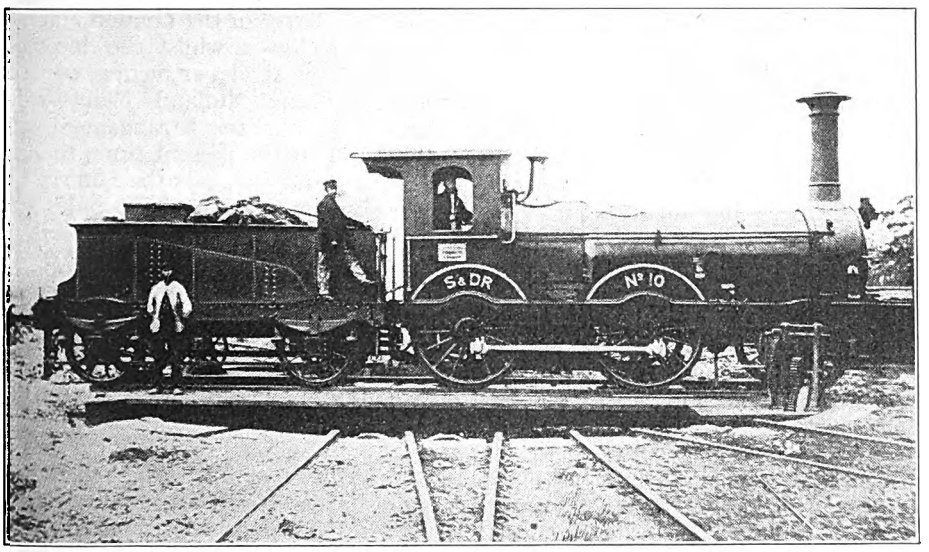
the single line coming from the opposite direction caused a very long delay. At Templecombe the clock, and the meal-times too, had utterly gone by the board. I know something of the sort must have happened because I remember wanting my supper there with a very great want. There was supposed to be a South Western train waiting at Wimborne about supper time to convey the Bath passengers to Weymouth, but whether it ever saw any Bath passengers from that particular Somerset and Dorset train I do not know, but I hardly think so. The trouble was that this was the last connection, and the Somerset and Dorset, for being particularly fond of railways and engines, the more time I spent on them the better I liked it.

On the journey from Wimborne to Bath, the trains gave one a frightful shaking up somewhere between Blandford and Shillingstone, and having got to Templecombe proceeded to perform something in the nature of "looping the loop." This was done by backing the train up the incline from the Somerset and Dorset line to the High Level South Western station, and once I remember they had backed half-way up when they found a goods train on the road, which they might have thought of before,



OLD 2-4-0 PASSENGER ENGINE No. 10.

Built by George England & Co., 1863.
Coupled wheels, 5 ft. diam. Cylinders, 16 in. by 18 in.

Somerset and Dorset attempted to make it by reaching Wimborne about 11 to 11.30 p.m., long after the South Western train had reached Weymouth. Bath passengers, therefore, put up at Wimborne for the night, and went round the minster next morning by way of compensation. The Wimborne station staff had to put up with considerable strong language, on account of happenings in the wilds of Somerset, which were not their fault, and they must have wished that the Somerset and Dorset had never been thought of as a railway. Nevertheless, taken all round, in my boyhood I did very well out of the with the result that the Somerset and Dorset "express" got tied up for half an hour before it could be extricated. I have called this train an "express"; really it was a so-called "fast" train of sorts, which left Wimborne after breakfast time and reached Bath too late for lunch and somewhat too early for tea.

How long the primitive methods of the Somerset and Dorset would have continued is hard to say, but the Radstock collision, which caused a sensation throughout the country, was probably the immediate cause of the drastic improvements which were subsequently made. The

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collision was a "head-on" one between two special trains on the single line between Radstock and Wellow. The traffic at that time was regulated by telegraph under the "control" of a "crossing agent," and also by single-needle block system. Both failed owing to bad methods of working, since, in the first place, no proper provision was made for the two trains to cross one another, and, secondly, ordinary block working was carelessly carried out. A number of holiday passengers for Bath were waiting at Radstock to return home late at night, and it was usual under these circumstances to send a train of empty coaches from Bath for their accommodation. This train ran when required, and was supposed to work to a definite schedule. The other train concerned was a special excursion from Wimborne to Bath for which no regular timing was in force, and it therefore depended upon the control arrangements made by the crossing agents. The empty special from Bath was considerably delayed in starting, and was therefore thrown out of its regular schedule, but the crossing agent was not apparently informed of this and appears to have acted as if it would reach Radstock at its usual time of 11.10 p.m. with some minutes to spare before the Wimborne special arrived at this station, where the "crossing" had been arranged to be made. The Wimborne train reached Radstock, but no instructions were apparently sent by the crossing agent to the station staff to keep it back until the Bath train had arrived, and owing to complete absence of proper arrangements for combined action between the crossing agent and the station staff, this train was allowed to proceed towards Wellow. Owing to the blunder of a youth who was supposed to watch the block telegraph instrument at Wellow the train from Bath was not signalled to the next box, for had the "Be ready" signal been properly given, the needle would have been pegged over to "line blocked," and the train from Bath would have been kept at Wellow. The youth saw that the needle of the block instrument was standing vertically, and took this to mean that the line was clear. Further, it appeared that there was no proper provision for the supply of oil for the signal lamps, and, without troubling further about the matter, the lamps of the distant signals were left unlighted. The net result was a disastrous head-on collision, similar to that of the celebrated Thorpe accident on the Great Eastern Railway, and 15 persons were killed.

Although the line had been leased to the Midland and the London and South Western Companies some ten months previously, parliamentary sanction for the lease was not obtained until about the time of the accident, and the slack methods of the old Somerset and Dorset working had not been so far interfered with, so that the railway was still carrying on with the old chief officials and staff in the same old way. When the re-organization took place the civil engineering side was put under the charge of the London and South Western Railway, whilst the locomotive and mechanical departments were controlled by the Midland Railway from Derby. This is the arrangement which holds good at the present time, though to all intents and purposes the Somerset and Dorset is worked as a joint independent company, with resident engineers and officials on the railway.

The old dark green passenger engines on the line were mostly of a diminutive 2-4-0 type, and were constructed in 1861-4 by Messrs. George England & Co., of Hatcham Ironworks, London. There were 13 or 14 of these little engines, of which the first series, built in 1861, had 5 ft. wheels and 15 in. by 18 in. cylinders, and the later six engines of 1863-4 had larger cylinders, 16 in. by 18 in. They carried a pressure of only 115 lb. per sq. in., and had a total heating surface of 849 sq. ft. Some of them had domes, and others domeless boilers, but all had a peculiar manhole and cover immediately in front of the raised firebox. A feature of most of them was a large cab which certainly gave most efficient protection to the men. An additional plate affixed to a few of them showed other ownership than that of the railway company, but whether these engines were lent on the hire system, or whether the company had pawned or mortgaged them I am unable to state. From the then financial condition of the line it is hardly too much to suppose that they had been pawned for a consideration. When the new tank engines of Mr. S. W. Johnson's design were placed on the line, the six old tender engines of 1863-4 were appropriated in

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1878 by the two owning companies, each taking three of them. The London and South Western relegated their three engines to the "Engineers' Department" with headquarters at Wimbledon, and of the engines taken over by the Midland* one was generally to be seen working the Harpenden and Hemel Hempsted branch in the early '80s. After August, 1878, the Somerset and Dorset saw them no more.

Of the remainder old Nos. 6 and 7 became 26 and 27 and were rebuilt as 2–4–0 side tank engines, and No. 8 was rebuilt as a saddle-tank engine, No. 28, for branch line traffic. They were afterwards rarely, if ever, seen at Bath, but confined their energies to the Burnham and Glastonbury branches.

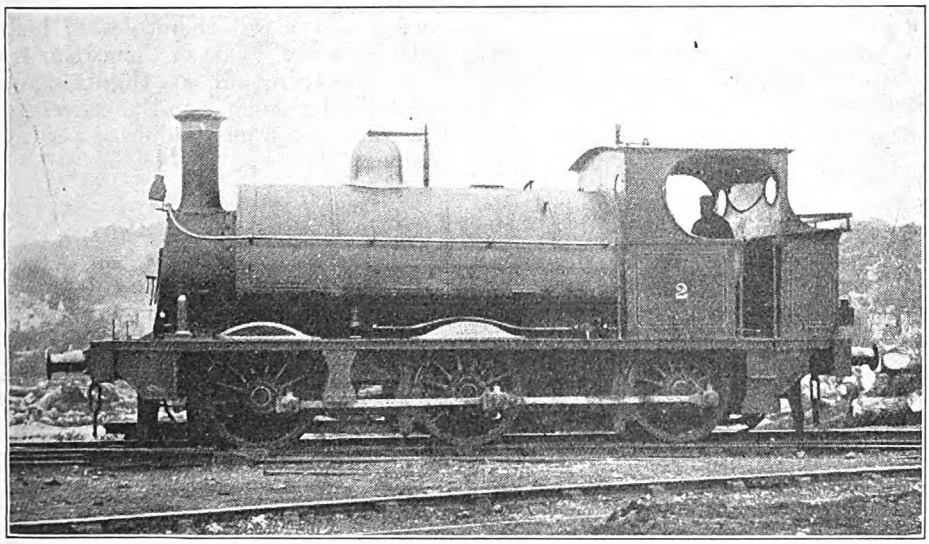
In 1866 the company had on order six much larger 2–4–0 engines from the Vulcan Foundry with 5 ft. wheels, and 17 in. by 22 in. cylinders, but only two of them, Nos. 15 and 16, ever made acquaintance with the Somerset and Dorset railway, for when the question of payment came up the others were apparently withheld, and in 1871 were sold to the Alsace-Lorraine Railways.

* These became M.R. Nos. 1397 to 1399.

The two largest engines on the line, Nos. 17 and 18, were purchased in 1866 from George England & Co. They were of Cudworth's standard South Eastern pattern with that engineer's patent double fireboxes, 6 ft. coupled wheels, 16 in. by 24 in. cylinders and double frames. The firm was at that time building a number of these engines for the South Eastern Railway and arranged to hand two of them over to the Somerset and Dorset.

These 18 engines apparently had to suffice for working the whole of the old main line between Burnham and Wimborne, and it does not appear that any provision was made for goods engines, except one 0–6–0 side-tank, No. 11, by G. England & Co. The line between Glastonbury and Wimborne is of an undulating character and by no means easy, so that the goods and mixed train loads of the little "England" engines, with their low pressure and 15 in. by 18 in. cylinders must have been very small.

Much more powerful engines were, however, necessary for the section between Bath and Evercreech Junction opened in 1874. The railway succeeded in obtaining these, but how it managed to pay for them is a mystery. Six of these engines,



0-6-0 SADDLE-TANK ENGINE (SERIES 1-9).

Built by Fox, Walker & Co., Bristol, 1874-6.
Coupled wheels, 4 ft. diam. Cylinders, 17½ in. by 24 in.

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Nos. 19 to 24, were built in 1874 by John Fowler & Co., of Leeds, and were of the 0–6–0 type, having 4 ft. 6 in. wheels and 17½ in. by 24 in. cylinders. In appearance they bore a marked resemblance to Mr. Patrick Stirling's Great Northern engines with that engineer's type of domeless boiler and style of cab. They carried 140 lb. pressure and weighed about 32¾ tons in working order. When Mr. Johnson's later goods engines of 1878 to 1881 appeared, Nos. 19 to 24 were transferred for goods traffic to the Highbridge–Evercreech section, where they generally remained. They were afterwards rebuilt between 1888 and 1893 with the Johnson type of boiler and 150 lb. pressure, but retained the Stirling cabs.

But the section between Bath and Evercreech required special engines for banking the goods trains over the very severe gradients. After leaving the junction with the Midland Railway at Bath there is an immediate severe rise of 1 in 80 to 1 in 50 for two miles up to Coombe Down Tunnel, with a 2-mile fall on the other side. After leaving Radstock there is a long bank over the Mendip Hills of about 7 miles varying from 1 in 50 to 1 in 80, and a similar steep fall for about 7 miles to Evercreech.

Of the banking engines provided, Nos. 1 to 9, five were built in 1874, and four others in 1876, all by Fox, Walker & Co. of Bristol. They were powerful 0–6–0 saddle-tank engines with inside cylinders 17½ in. by 24 in. and wheels 4 ft. diameter. They carried 140 lb. pressure and weighed 45½ tons in working order. Nearly all these engines were always stationed at Bath until the very recent 2–8–0 engines were built in 1914 at Derby. One of them, No. 1, was subsequently rebuilt at Highbridge as a 0–6–0 tender engine, and another, No. 8, was converted from a saddle to a side tank engine.

(*To be continued.*)

ON THE SOMERSET AND DORSET JOINT RAILWAY OF TO-DAY.

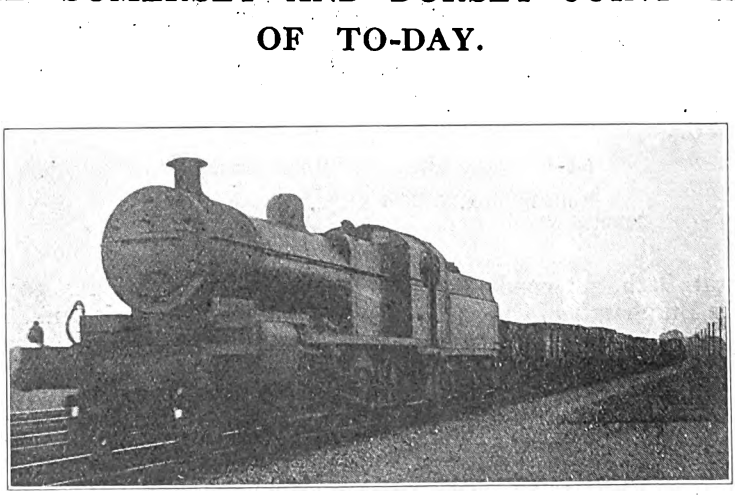

Photo.] [*Chas. S. Lake.*

2-8-0 LOCOMOTIVE ON UP GOODS TRAIN NEAR MILLBROOK.

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The Country Extensions of the Metropolitan Railway.

By W. E. EDWARDS.

THE formal opening on August 2, 1880, of the extension to Harrow-on-the-Hill of that which was originally known as the "St. John's Wood Line," was heralded by the following official notification :—

METROPOLITAN RAILWAY

NEW ROUTE
TO
HARROW
will be opened
BANK HOLIDAY, AUGUST 2.

TRAINS EVERY HALF-HOUR

The Station at Harrow is at the foot of the Hill, close to the Town, Schools, Assembly Rooms, Cricket and Football Match Grounds, &c., &c.

The event marked a fourth epoch in the remarkable development of London's original "Underground," which eventually culminated in a junction with the London & North Western Railway at Verney, after traversing sections of Middlesex, Herts, as also Bucks, stopping short, in fact, but little outside the County of Oxford. Of the three former stages it suffices to quote the "Railway Year-Book," which records the following opening dates, viz., Baker Street to Swiss Cottage, April, 1868; Extension to West Hampstead, June 30, 1879; Extension to Willesden Green, November 24, 1879; while the additional 5¾ miles to Harrow marked the first real step towards the transformation of the railway into a "country line." The accustomed opposition to the scheme had been encountered on the part of the London & North Western Railway, as was natural, whilst the objections at first urged by the School and town authorities were, perhaps, not wholly unjustifiable.

Upon the previous Saturday (July 31, 1880) a party of inspection arrived at Harrow from Willesden Green, including Sir E. Watkin, the Chairman; Mr. H. D. Pochin, Deputy Chairman; Mr. A. Cassells; Mr. B. Whitworth, M.P.; Mr. G. Morphetts; Mr. A. M. Watkin; Lord Alfred Churchill; Mr. C. McLaren, M.P.; Sir M. Peto; Colonel Surtees, &c. An adjournment was made to that long-famous hostelry, the "King's Head," where 250 guests were entertained; an emblazoned device overhead bearing the words, "Stet furtuna domus." The toast of "The Queen" was proposed by Sir E. Watkin, while, on behalf of "The School," Mr. R. B. Hayward, M.A., responded, in the absence of the Head Master. Lord A. Churchill observed that the Harrow Extension was "the first attempt of the Metropolitan Railway to put its claws out of the Metropolis; they would now be able, under the management of their Chairman (Sir E. Watkin), to travel thence to Brighton without change of carriage."

The Engineer responsible for the new work was Mr. Charles Liddel, a relative of the then well-known Dean of Christ Church, Oxford, the Contractor being Mr. Joseph Firbank. The new stations at Kingsbury and Harrow were built from designs by Mr. McDermott. Upon the return of the special train to Willesden Green, a free trip was largely patronised by the youthful residents of Harrow. At that period no station existed at Wembley Park, nor, of course, did the still later "halt" at Preston Road. No goods accommodation was, as yet, provided for Harrow, although an intimation that such would be the case was conveyed during the course of the festivities above noted, while the business resulting therefrom eventually proved to be of a highly satisfactory character, whatever may be the situation to-day in this respect. The up platform of the passenger

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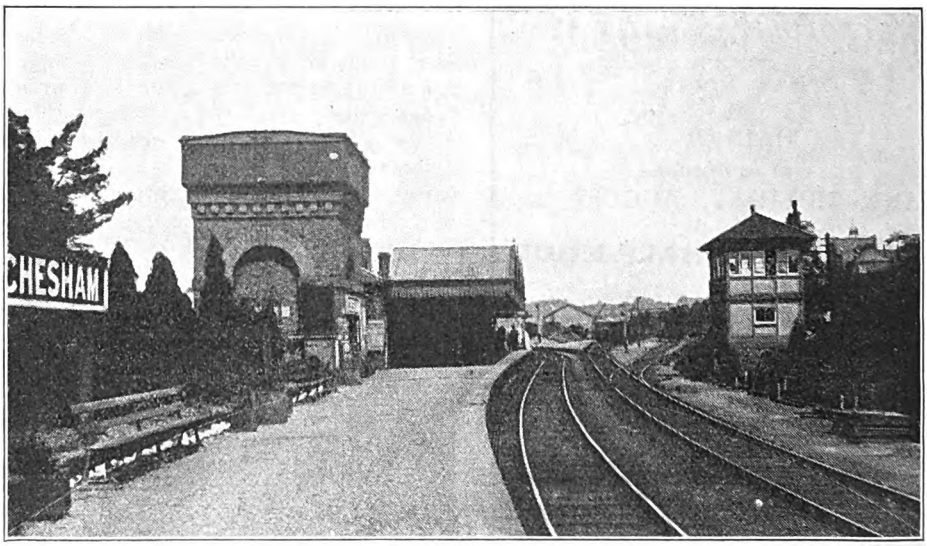
station (now an " island ") was not brought into use for a long period, nor was a foot-bridge provided, so that passengers arriving from the Wealdstone direction crossed the rails at the level in order to reach the present No. 1 platform, from which the up trains departed.

A permanent-way improvement noted at the period was that " the fish-plates clip the under flange of the rail," whilst a considerable portion of the new road was laid upon steel sleepers, which the men, not inaptly, termed " pig-troughs " ; some of them are still to be seen in the Rick-

Passenger rolling-stock was of the long-familiar " tunnel " type, containing the accustomed advertisements as of yore, while the first-class coaches were still distinguished by the cream-coloured upper panels. Edgware Road supplied the locomotive power, which consisted at first entirely of the old-time " Fowler " type, including even the goods working, which was very efficiently and promptly performed by the erstwhile denizens of the then sulphurous tunnels. They continued to be " cabless " for a long period, while a veteran of the series has been but recently



GENERAL VIEW OF CHESHAM STATION.
Goods yard in background.

mansworth sidings at the time of writing. The interlocking of the points and signals was on a system covered by a Saxby and Farmer patent, and the block telegraph instruments were those of the Spagnoletti, or Great Western, type adopted from the very outset of the Underground system, combined, however, in later years, with the lock-and-block, both of which methods are still employed below Harrow, as heretofore. The daily service first consisted of 36 trains to and from Baker Street, with a Sunday service interrupted by the then customary " Church interval " between 10.30 a.m. and 1 p.m. The passing of that observance marked a stage in a direction with which we are too familiar to-day.

so fitted. It was one of that type of locomotive, bearing upon each tank the Prince of Wales' Feathers, which conveyed the late King Edward to Waddesdon Manor during the reign of Queen Victoria.

The extension to Pinner was inaugurated on Saturday, May 23, 1885, by the arrival of an engine and single coach, on a trial trip, the party of inspection including Mr. John Bell, the General Manager, and Mr. F. D. Crapp, Superintendent of the Line. Two engines were also employed upon each road to test the rails. The public opening, without ceremony, took place upon the Monday following.

Next followed the opening of the line to Rickmansworth, on Thursday, September 1, 1887, again without ceremonial,

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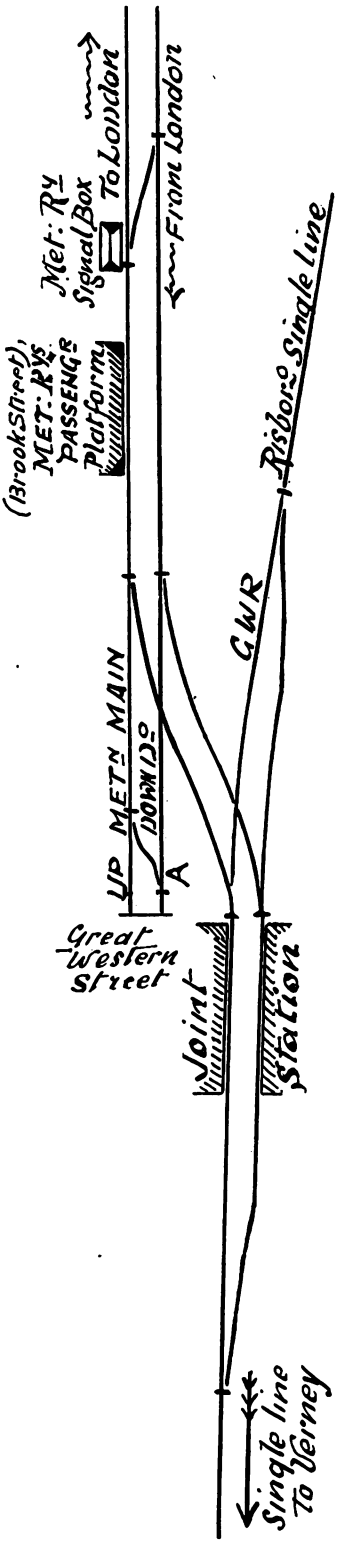
among the first passengers being the writer, the event arousing but little public interest on the part of a town then, as now, temperamentally apathetic in tone. The section from Pinner had been duly inspected on the previous Tuesday by Major-General Hutchinson, accompanied by Mr. Liddel, Sir E. Watkin, and the General Manager, Mr. J. Bell. It may be added that a horsed omnibus, locally owned, conveyed passengers to and from the Griffin Inn, Amersham.

It may be interesting to recall the words of a writer of that period in reference to the Rickmansworth Extension, who propounded the question as to what could be the object of carrying the line through a district consisting only of farms and fields? Rumours, however, were already current as to a probable extension to Aylesbury, yet, at the general meeting of the Metropolitan Company, only five weeks previously, Sir E. Watkin declined to make any reply to a question upon that subject. No information was, moreover, vouchsafed beforehand as to rates or fares, but the issue of "third returns" between Baker Street and Rickmansworth at a cost of 1s. 11d. only, exceeded all expectations on the part of the public, and some considerable time elapsed before the London & North Western Railway made an approach to a corresponding reduction in consequence. The original daily service to and from Baker Street consisted of 33 trains. It is recorded that, during the first month (September, 1887), 63 passengers booked from King's Cross to Rickmansworth, whilst those from Baker Street numbered 262. By reason of the action of the late owner of Rickmansworth Park, it was necessary to lay out the railway entirely outside that domain; hence the existence to-day of the objectionable curvature and speed limitation.

The single line between Chalfont Road and Chesham was opened, unceremonially, on Monday, July 8, 1889. The Metropolitan Company's original intention was to provide a station for Chesham some half a mile outside the town, in the Mill Field. The residents, however, raised by subscription the sum of £2,000, which was presented to the railway company for the purchase of the present centrally-situated site. A committee of the townsmen was



PLAN OF AYLESBURY STATION AS ORIGINALLY CONSTRUCTED.

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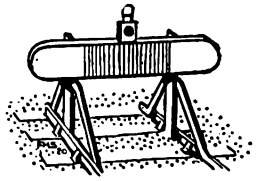
appointed in order to carry out a scheme of decoration in view of the opening of the line, and their wish so to act was voiced by the Town Crier, but the necessary support was not forthcoming. The station approach, however, displayed an illuminated device, doubtless suggested by Hymns A. and M., and bearing the words, "Forward be our Watchword." Over the present signal-box floated a large red flag having "Metropolitan Railway" inscribed thereon. No less than 1,500 passengers travelled over the branch upon the opening day, whilst upon the following day 300 tickets were issued to the Crystal Palace. The first train departed from Chesham at 6.55 a.m. upon the date already noted, when a large assembly witnessed that event. It may be noted that originally the Baker Street trains divided at Chalfont Road, thereby relieving Chesham passengers from the trouble of changing, and the cessation of that method greatly displeased Chesham folk at the time. This branch, after leaving the main line, follows a winding course, involving a series of reverse curves which remind the passenger of Lord Grimthorpe's dictum that "if you look out of the window you may see the tail lamp of your own train." The further extension from Chalfont Road to Aylesbury, as well as its opening on September 1, 1892, has been already recorded in Volume 23 of the RAILWAY MAGAZINE, and it may be interesting to add that the first station master at Aylesbury, that is to say, at the original Metropolitan station in Brook Street, has but comparatively recently retired from service at Harrow, whence the disuse of the temporary station (at Aylesbury) involved the transfer in question. A well-nigh forgotten fact may here be recalled in connection with the outdoor signalling of the Willesden-Harrow section at the outset. The "balanced" system of the Great Northern type was there adopted, saving that the semaphore arms fell only to the "45" position; the signals long continued in use, but were ultimately replaced by the (now) "old" pattern of the Metropolitan Railway. In Volumes 23 and 24 Mr. Bennett has very ably dealt with Metropolitan locomotive history, wherein is recounted a mishap at St. John's Wood Tunnel, in 1891, to engine No. 67, the first of the "South Eastern," as also the "cabbed" type. She was also one of the first Metropolitan locomotives to be stationed at Aylesbury at the very outset in "ninety-two," working thence four trips to and from Baker Street daily for a considerable period. The line at that time was closed during the night, and it was thus necessary each night to advise Edgware Road by telegraph of the arrival of the engine of the last down train, which was reported as being fit for duty on the following morning. As the telegraphic circuit extended upwards only to Chalfont Road, the signalman there remained on duty until this message was received and transmitted to London.

It may to-day be of interest to recall the original working of the Metropolitan Railway at Aylesbury in the days of the independently owned station of that company. A facing cross-over line existed at the signal cabin whereby the down trains arrived at the platform upon the up side, the engine then running, still downward, on the up line to the cross-over A, thence returning upwards on the down rails over the signal-box cross-over, backing thence on to the train in readiness for the upward journey. These original main lines still exist in the form of sidings at the present time. The junction points with the Great Western Railway were controlled at the one end by the Metropolitan signalman, at the other by the Great Western man, catch points protecting the two companies' lines in each direction. The reverse curve formed by these arrangements led, it will be remembered, to ultimate disaster.



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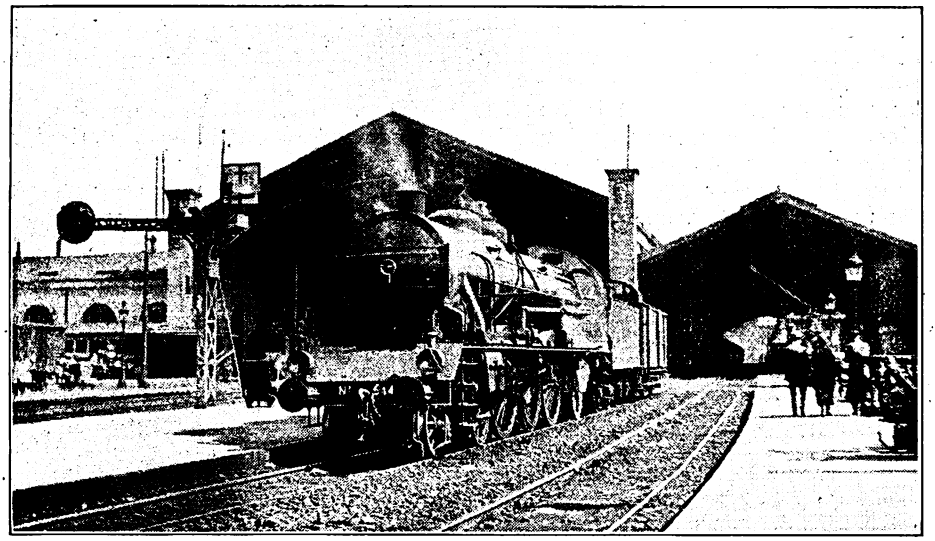

Photo.] C. DE FER P.L.M. [*C. B. Farrar.*

Large 4-6-2 locomotive at Lyons, after working the Marseilles-Paris "Rapide."

Modern Locomotive Practice on French Railways.

By G. VUILLET.

IN order to understand modern locomotive practice in France it is necessary to consider earlier stages of development. Four-cylinder compound locomotives of the 4-4-0 type were placed in service on most French lines between the years 1891 and 1900, and the latter year witnessed the appearance on the Northern Railway of the celebrated "Atlantics." The excellent results achieved by this class induced the other lines to build machines of the same type, and thus set up a standard for French locomotive practice which lasted for over fifteen years.

An example of the capabilities of these comparatively small machines is found in the fact that during the official speed tests of the C. de fer du Nord "Atlantics," No. 2643 attained a speed of 95·3 m.p.h. (153·3 km.) whilst running on a down gradient of 1 in 330 with a load of 280 tons behind the tender. This performance took place in the neighbourhood of Albert, between Arras and Longueau, and is equivalent to hauling 200 tons on the level at the same speed. The motion of the engine was remarkably smooth up to 80 m.p.h., but the regulator had to be closed at 95 m.p.h., although the machine was not giving its full power, because it was feared that derailment might occur. The 4-4-2 compounds built for other lines proved equally successful. The class in service on the Paris-Orleans Railway hauled a load of 350 tons at 69·6 m.p.h. on the level.

Recently the Nord "Atlantics" have been superheated, and in their modified condition are capable of keeping hard timings with loads exceeding 400 tons. The writer travelled from St. Quentin to Paris towards the end of August last behind No. 2670 with 427 tons behind the tender. The time taken for the 95·1 miles was 103 min., four min. therefore being gained on schedule. A speed of 65·3 m.p.h. was attained on the

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level, and the average for the seven miles up at 1 in 200 from Chantilly to Survilliers was 43 m.p.h.

Consequent upon the excellent results obtained, the French lines up to 1910 built only compound locomotives. In the meantime other countries had resorted to superheating, and the question then arose as to whether the reduction in steam consumption effected by the latter method was not more economically arrived at by compounding. A number of mixed-traffic two-cylinder simple superheater 10-wheelers were built in 1910–11 for the Orleans, Midi and State Railways, compounds was therefore fully shown at that time for both mixed-traffic and express services.

There remained the question as to whether the advantages derived from compounding could add to those due to superheating, or whether superheating alone would result in such an economy as to render the expense of compounding unjustified. As far back as 1908 a four-cylinder compound 4-6-0 of the Western Railway was superheated, and tests carried out between Paris and Rouen showed an economy in coal of 10 per cent. as compared with non-superheated com-

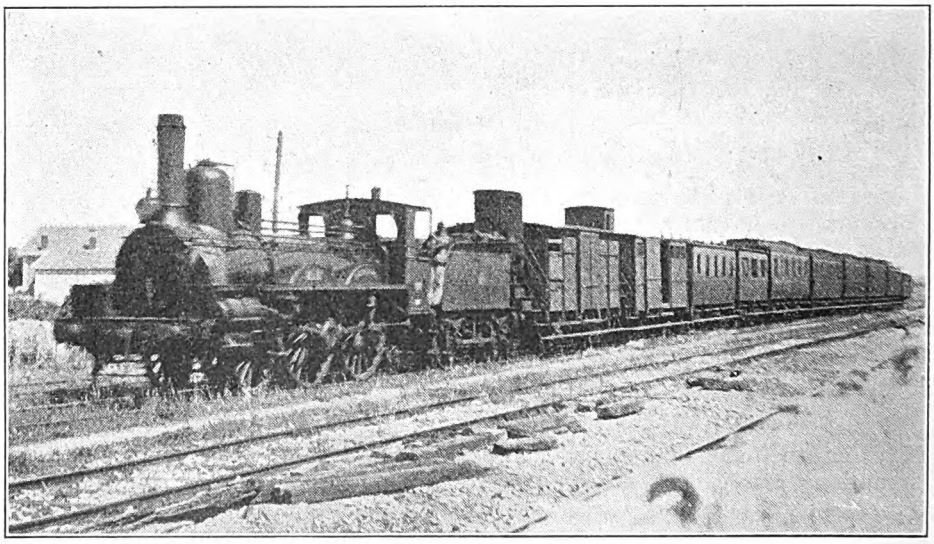

Photo.] C. DE FER DE L'ETÂT. [*C. B. Farrar.*

Old 2-4-0 locomotive on Rochefort–Le Chapus local train.

and proved superior in performance and lighter on repairs than the four-cylinder non-superheated compounds previously used on the same services.

Midi locomotive No. 3507, of this type, hauled during a test run a load of 700 tons at a speed of 56 m.p.h. on the level, the train being made up of 11 loaded 50-ton coal cars.

The P.L.M. tests of 1911 between "Pacifics" of identical construction, except that one was a four-cylinder non-superheater compound and the other a four-cylinder superheater simple, showed an economy in coal consumption of 16 per cent. in favour of the simple. The superiority of superheated locomotives over pounds. The P.L.M. superheated in 1911 the compound "Pacific" No. 6001 and tested it against four-cylinder simple No. 6101. The results shown by the compound were found to be as superior to those furnished by the simple as those the latter machine had given over the compound in its primitive state. The tests were repeated in 1913 with 4-6-2 No. 6206, of a series specially built to use superheated steam, and the results of these tests were published in detail in the *Locomotive Magazine* for February, 1917. Probably the best performance recorded was to ascend 19·4 miles with an average gradient of 1 in 188, and the last nine miles varying from 1 in 140 to 1 in 125, at a speed of 50·3 m.p.h., with

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a load of 635 English tons behind the tender, the maximum horse-power developed in the cylinders being 2,425.

Other French lines built machines of the same general type. A Midi 4-6-2 No. 3052 attained a speed of 87 m.p.h. on the level at the trials, but with the light load of 130 tons only behind the tender. During the war, in spite of the bad quality of the fuel available, the superheated compounds rendered excellent service, regularly hauling loads of 600 to 650 tons, and occasionally over 700 tons. Since 1918 machines of the existing types have been superheated as they have passed through the shops. This alteration has been facilitated by the adoption of the "small tube" type of superheater, utilising nearly all the tubes in the boiler, and by doing away with any modification in the number and diameter of the tubes.

The high cost and scarcity of skilled labour prevailing in recent years has again drawn attention to the increased cost of maintaining in perfect running order locomotives of the four-cylinder type. The technical superiority of a four-cylinder superheater compound over any type of simple has been proved many times not only in France but in Germany (on the Prussian State Railways), and in Switzerland (during tests made on the St. Gothard line with a four-cylinder 2-10-0) and in other countries. But when labour is scarce and expensive it is questionable if the economy in coal consumption justifies the increased cost of maintaining four-cylinder compounds. In practice, therefore, some lines have adopted compounds and others two-cylinder simples. Some lines have adopted both types, in which cases the compound system has been utilised for the most powerful locomotives. French lines generally follow the latter course, and a few examples will serve to illustrate how the principles just mentioned are brought into practice.

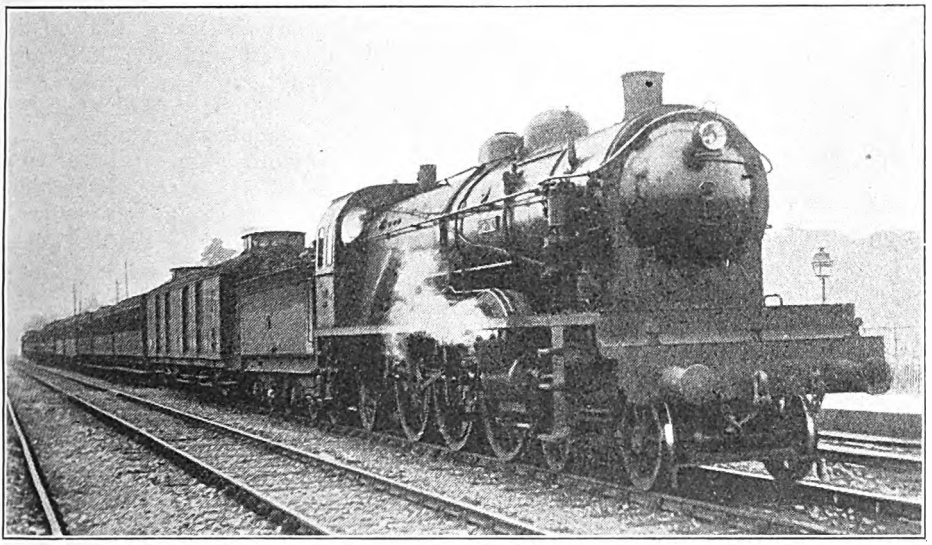

Photo.] C. DE FER DE L'ETÂT (OUEST). [*W. H. C. Kelland.*

4-6-2 locomotive No. 231–707 on express passing Poissy.

In 1914 the first engine of a new "4-6-2" class made its appearance on the State Railway. This machine can be regarded as a development of the standard 4-6-2 superheated compounds then in use on the Orleans and Midi Railways, with the novelty of a round-topped firebox of the Crampton type instead of a Belpaire one, this alteration having been made in order to allow, from the footplate, a better view of the line ahead. As in all de Gleln-du Bousquet compounds, the high-pressure cylinders, 16·53 in. in diameter, are placed outside

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the frames, and drive the intermediate pair of coupled wheels, whilst the low-pressure cylinders, 25·19 in. in diameter, drive the leading coupled axle. The stroke is 25·60 in. both for high-pressure and low-pressure cylinders. The reason for placing the high-pressure cylinders outside and the low-pressure inside the frames is that a more convenient arrangement of steam pipes can be obtained in this manner, and that the condensing effect of cold air on the outside cylinders is reduced to a minimum. Steam is distributed by piston valves to the high-pressure cylinders and by balanced slide valves to the low-pressure cylinders, two independent sets of Walchaert valve-gear being used. An intercepting valve, operated by compressed air, allows the engine to be run as a four-cylinder simple if and when maximum tractive effort is required. By-pass valves connected with the regulator are also worked by compressed air. The driving wheels are 6 ft. 4·37 in. diameter, and are spaced symmetrically 6 ft. 8·66 in. between centres. The bogie wheels have a diameter of 3 ft. 1·7 in., and the trailing wheels 4 ft. 0·4 in. The springs of the coupled and trailing wheels are of the flat underhung type, and are united by equalising beams. The Westinghouse high-pressure brake acts on all wheels except the trailing, and pneumatic sanding gear is provided for the first and third pairs of coupled wheels, with hand gear for the middle pair.

The boiler, the centre line of which is pitched 9 ft. 4$\frac{3}{16}$ in. above rail-level, has a smallest interior diameter of 5 ft. 6$\frac{1}{8}$ in., and contains 151 tubes 1·97 in. inside diameter and 24 flues 4·92 in. diameter. The length of the tubes is 19 ft. 4$\frac{5}{16}$ in. The round-topped firebox is 10 ft. 2 in. long and varies in width from 6 ft. 10$\frac{5}{8}$ in. to 3 ft. 11$\frac{1}{8}$ in.

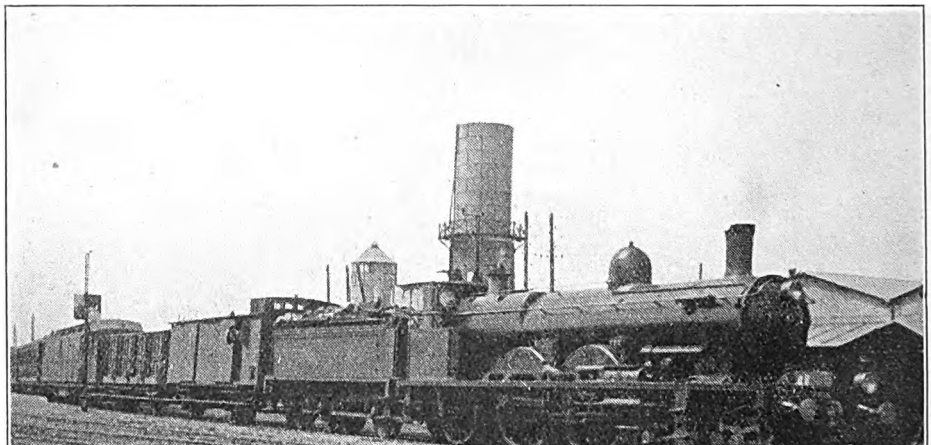

Photo.] C. DE FER DU NORD. [*G. Vuillet.*

de Gleln 4-4-2 locomotive on train.

Fireboxes of this type can be provided with a large grate area without altering the framing, and are slightly less heavy on repairs than the ordinary type of wide firebox. The rocking grate has an area of 45·96 sq. ft. Steam pressure is 228 lb. per sq. in. A Schmidt superheater is provided, giving a superheating surface of 683·51 sq. ft., which, added to the 2,105·43 sq. ft. of the tubes and the 176·20 sq. ft. of the firebox, brings the total heating surface up to 2,965·14 sq. ft.

It is necessary to explain here that the heating surfaces are generally computed on the Continent on the side exposed to

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the fire. The tubular heating surface is, therefore, about 10 per cent. smaller and the superheating surface larger by about 20 per cent. than if the basis had been taken on the water side, as in Great Britain.

Speed indicators are compulsory on passenger locomotives in France, and the one fitted to the design under notice is of the Flaman type. The tender runs on two four-wheeled bogies and carries 6 tons of coal and 4,840 gallons of water. The weight of the engine in running order is 96 tons 3 cwt., of which 56 tons 10 cwt. are available for adhesion, whilst the tender weighs full 51 tons 13 cwt. These powerful machines have given excellent results and can haul over 600 tons at 62 m.p.h. on the level. The speed limit for this class is 80·8 m.p.h. (130 kilometres).

Many lines other than the State have machines of this type in service. The Northern Railway owns one, which was taken when only half completed by the Germans and recovered by the Nord Company after the Armistice. Others are at work on the Orleans, Est and Alsace-Lorraine lines. The total number of machines of this type in existence is now about 400.

As an example of the fine work performed daily by these engines, brief reference may be made to a run recently between Troyes and Paris on the express from Basle to Paris, due at the Gare de l'Est at 2 p.m., hauled by the State type 4–6–2, No. 31,033. The weight of train was 500 tons, and the engine attained and maintained on the level a speed of 69·6 m.p.h., also ascending a bank of 10 miles at 1 in 187 at an average speed of 45·5 m.p.h.; minimum speed 42 m.p.h. The 37·8 miles from Nangis to Noisy le Sec were covered at an average speed of 65·8 m.p.h. although this section includes a stretch of 8 miles up at 1 in 350. The average speed from start to stop was exactly 57 m.p.h.

The P.L.M. owns a large number of "Pacifics," of which 91 were built as four-cylinder simples and bear the numbers 6,101–6,191. Nos. 6,101–6,171 have a working pressure of 170 lb. per sq. in., whilst Nos. 6,172–6,191 work at 200 lb. The latter class are being rebuilt as compounds. The original compounds, however, form the most numerous class, and the latest batch was delivered from the builders in 1923.

The P.L.M. compounds differ from the other types in use in France in having the low-pressure valves arranged to give a constant cut-off of 63 per cent. instead of a variable cut-off. When running with a high-pressure cut-off of about 60 per cent. the work is practically equally divided between the high-pressure and low-pressure cylinders. With a different cut-off in the low-pressure cylinder the work tends to become disproportionate in the respective groups. This inconvenience is of no great importance in practice, as the cylinder ratios have been calculated to give the best all-round results. In the first engines built, separate sets of valve gear were provided for the inside and outside cylinders, but in order to reduce the number of moving parts and consequent resistance of the mechanism, engines built since the war have been fitted with only two sets of valve gear, the inside valves being driven from the outside links through rocking arm shafts attached to the radius rods. The inside links and eccentrics are, therefore, dispensed with, but the lead levers uniting the inside crossheads to the valve spindles are retained. It follows from this that the cut-off to the two pairs of cylinders is interconnected, only one reversing mechanism being required, and the low-pressure cut-off is no longer constant. Some difficulty was experienced in running at high speeds with the earliest engines fitted with this type of valve gear, but by strengthening the gear then in use this defect has been overcome and engines fitted with the improved type have attained speeds exceeding 80 m.p.h.

The high-pressure cylinders placed outside the frames are 17·32 in. in diameter and drive the intermediate pair of coupled wheels, whilst the low-pressure cylinders, 25·60 in. in diameter, drive the leading coupled axle. Piston valves actuated by Walchaert valve gear are used for both sets of cylinders. The driving wheels, 6 ft. 6·7 in. diameter, are spaced symmetrically 6 ft. 10·6 in. between centres. The diameter of the bogie and trailing wheels is 3 ft. 3·35 in. and 4 ft. 5·5 in. respectively. Both bogie and trailing truck are connected to the main framing by a spherical pivot resting in a socket whose lateral displacement is controlled by inclined planes. Equalising levers

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unite the springs of the coupled axles. The Westinghouse-Henry automatic and variable brake acts on all wheels except the trailing.

The boiler has its centre line pitched 9 ft. 6 in. above the rail-level and measures 5 ft. 6⅛ in. inside diameter. There are 143 tubes, 1·97 in. diameter, and 28 flues, 4·92 in. diameter, with a length of 18 ft. 0½ in. The firebox is of the round-topped radially-stayed type, with side sheets spread out so that the grate, which has an area of 45·94 sq. ft., extends over the framing, the ashpan being in three divisions. The heating surface of the firebox is 168·4 sq. ft., and that of the tubes is 2,007·4 sq. ft. A simple type of superheater is provided, no dampers being utilised, with the result that the interior of the smokebox is relatively clear; the volume of the smokebox, the length of which is not less than 9 ft. 10 in., is also increased. Superheating surface is 694 sq. ft. A variable blast pipe is provided, the movable piece of which has the form of a trefoil tapering downwards in the shape of a wedge. The walls of the wedges have a slightly helical curvature, which imparts a vortical movement to the three streams into which the exhaust is split.

Locomotives fitted with this new type of blast variator can haul loads 15 per cent. heavier than those fitted with the standard simple cone pattern. The equipment includes two "Pop" safety valves fitted on the boiler, a Flaman speed indicator in the cab, and the controls are so placed that they are easily accessible from the seats of the driver and fireman. Total weight in working order is 89 tons 16 cwt., of which 54 tons 14 cwt. are available for adhesion.

The results obtained by these machines have already been referred to above, but it may be noted here that the maximum i.h.p. of 2,425 was obtained with an engine fitted with the simple cone type of exhaust and is therefore somewhat inferior to the capacity of the engines as they are now running. In every-day working results equivalent to those of the tests have been obtained, and when making up lost time the speed maintained on the 1 in 125 gradient from Thenissey to Blaisy-Bas, with loads exceeding 400 tons, is sometimes as high as 55 m.p.h. Quite recently No. 6309 was delayed at the start and regained 27 min. between Paris and Laroche, covering the 96·3 miles in 106 min., with the enormous load of 551 tons behind the tender. This run was made

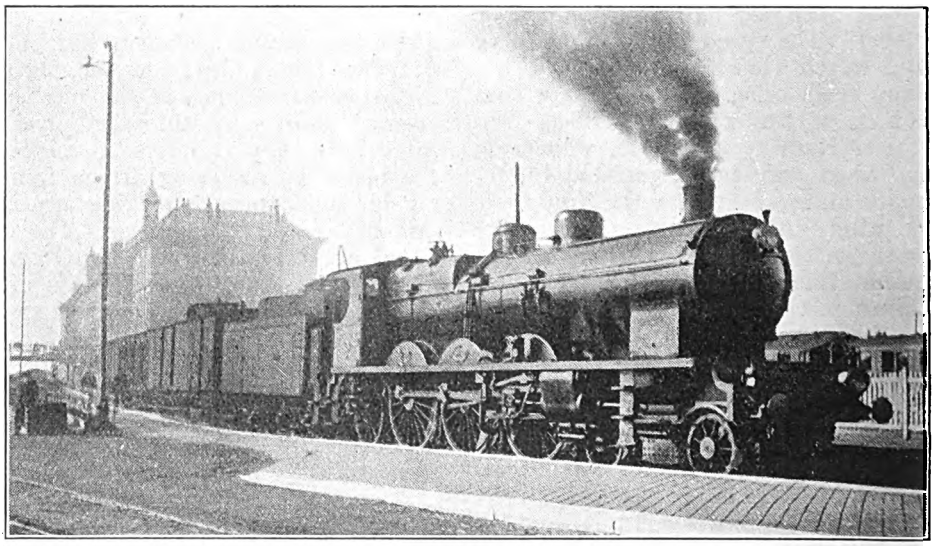

Photo.] C. DE FER DU NORD. [*J. Macartney Robbins.*

4-6-2 superheater locomotive No. 3.1162 on train at Calais Maritime station.
Fitted with large bogie tender for working the Paris–Brussels non-stop express when required.

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on a night train, and the production of electric light—as shown by tests made in 1911 on the Orleans Railway—is equivalent to an increase of 10 per cent. in the tare weight. A start to stop speed of 54·5 m.p.h. had therefore been maintained on a line rising 150 ft. from end to end, with a load equivalent to 600 tons behind the tender.

The latest express locomotives of the Orleans and Midi Railways are two-cylinder simples. In view of the re-organisation of the main-line services which had been decided upon for 1921, an order for 50 two-cylinder simple "Pacifics" was given to the American Locomotive Sales Corporation towards the end of 1920. The design was evolved in the offices of the American Sales Corporation in conjunction with engineers of the Orleans Railway.

The boiler is of the straight top type with a diameter at the first ring of 5 ft. $4\frac{5}{8}$ in. There are 165 tubes and 26 flues, respectively, 2 in. and $5\frac{3}{8}$ in. diam. The length between tube plates is 20 ft. The steel firebox is a novelty for French express locomotives. Experience has shown that no disadvantage arises from the use of this material, provided certain precautions are taken, especially when washing. The grate area is 50·4 sq. ft. obtained with a length of 8 ft. $0\frac{1}{4}$ in. and a width of 6 ft. $3\frac{1}{4}$ in. The total heating surface (including superheater) is 3,176·6 sq. ft., of which 154·2 sq. ft. is provided by the firebox. The superheater, of the Locomotive Superheater Company's type without dampers, has a heating surface of 776·4 sq. ft. The steam pressure is 170·6 lb. per square in. Bar framing is used, as also the American type of swing-centre bogie and a Cole-Scoville trailing truck. The cylinders, which are $24\frac{3}{8}$ in. diam. and have a $25\frac{3}{5}$-in. stroke, drive the middle pair of coupled wheels, the diameter of which is 6 ft. $4\frac{3}{4}$ in. The diameters of bogie and trailing wheels are respectively 3 ft. $2\frac{3}{16}$-in. and 4 ft. $\frac{13}{16}$ in. Walchaert valve gear is used to drive the inside admission piston valves and lubrication is effected by means of a Detroit condensation lubricator. To allow free running when the regulator is closed, safety valves and a by-pass are fitted to the cylinders, with a valve admitting air on the steam chests. Total weight in working order is 92 tons 19 cwt., of which 53 tons 16 cwt. are available for adhesion. The tender, carried on two four-wheeled bogies, carries 4,840 gallons of water and 9 tons of coal, and weighs full 54 tons 2 cwt. It can be seen that the design is mostly American, the only important difference being that the exhaust

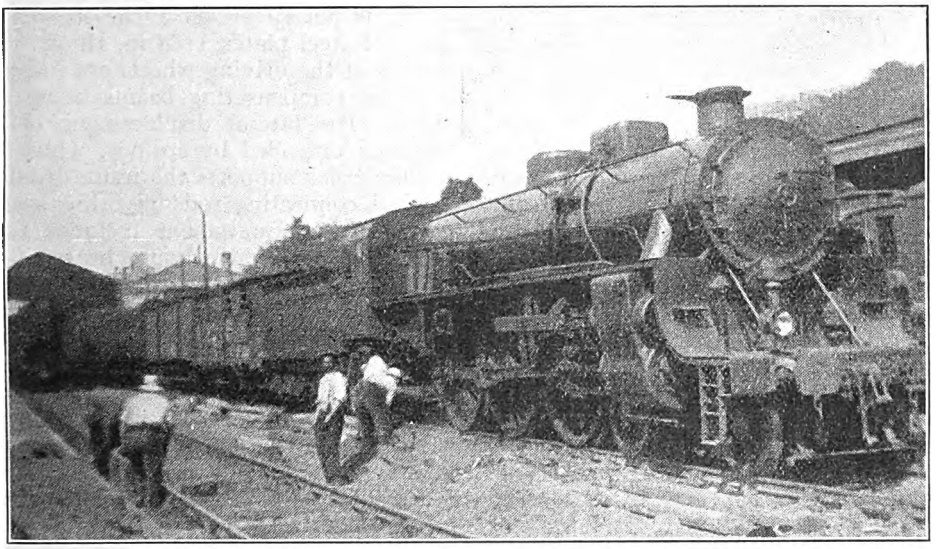

Photo.] C. DE FER PARIS-ORLEANS. [*J. Macartney Robbins.*

American-built 4-6-2 locomotive No. 3598 on train at Poitiers.

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is of the movable cone type instead of the fixed variety.

Results given by these machines are excellent. Although only two cylinders are used, so that balancing cannot be obtained in the same perfect manner as with four cylinders, the stability of the engine is remarkable, even at speeds exceeding 80 m.p.h.

The expense of upkeep is greatly reduced, with the result that the total cost of coal consumption and maintenance is about the same as that of a compound locomotive. An example of the duties performed by these machines is provided by the following run from Bordeaux to Angoulême, made on the 3.5 a.m. night "Rapide" from Bordeaux to Paris behind No. 3622. The train was made up of 13 cars weighing 465 tons tare and 500 tons full. The remark previously made concerning electric lighting also applies here. The usual speed restrictions and a p.w.r. slack resulted in 35 min. 30 sec. being taken for the 22·6 miles to Libourne. A subsequent speed of 63 m.p.h. was maintained from the latter town to Coutras, 32·6 miles, and 56 m.p.h. was the speed on the faintly rising stretch to Parcoul-Médillac, 48·3 miles. The next 14 miles, averaging 1 in 600 up, were covered at 46 m.p.h., and the minimum sustained speed on the following 6 miles at 1 in 190 was 40 m.p.h. On the down grades the maximum speed was 68 m.p.h., so that the 83·5 miles were covered in 113 min., or 104 min. net. A gain of 9 min. on schedule stood to the credit of the engine.

The Midi Railway was the first French line to revert to the use of two-cylinder simples in conjunction with superheating, and a design of 4-6-2 express locomotive of this type had been prepared in 1914. The engines were, however, only delivered in 1921. They are numbered 3101–3120 and were built by the Société Alsacienne at Belfort. The boiler, the centre line of which is pitched 9 ft. $4\frac{3}{16}$ in. above rail level, is made of three rings and contains 123 tubes 1·97 in. diam. and 28 flues 4·92 in. diam. The length of the tubes is 19 ft. $10\frac{5}{8}$ in. and the inside diameter of the largest rings is 5 ft. $6\frac{3}{4}$ in. The round-topped firebox is similar to the one already described for the State railway's "Pacific," but the grate area is only 43 square ft. The heating surfaces are as follows:—Firebox, 171 square ft.; tubes, 2,008 square ft.; superheater 792·5 square ft. A conspicuous feature of the design is the large proportion of the superheating surface as compared with the total heating surface. The previous type of "Pacific" was only provided with 24 flues instead of 28 as in the present one. Steam pressure is 185 lb. per square inch. The cylinders measure $24\frac{3}{4}$ in. diam. and have a stroke of 25·6 in. Drive is taken on the middle axle. The coupled wheels are 68 in. diam., whilst the bogie and trailing measure respectively 2 ft. 9·6 in. and 4 ft. 0·4 in.

Inside admission piston valves are fitted, actuated by Walchaert valve gear. The design is purely French: the frames are made of steel plates 1·38 in. thick. The springs of the driving wheels are independent, no compensating beams being provided. The lateral displacement of the bogie is controlled by springs, whilst the trailing truck supports the frame by short vertical connecting rods pivoting around two centres. Equipment includes Coale safety valves, Westinghouse brake, Gresham steam sanding apparatus and Hausshaelter speed indicator. Lubrication is provided by means of a Detroit five-feed lubricator. The weight in running order is 87 tons 14 cwt., of which 53 tons rest on the driving wheels. These engines have proved 9 per cent. more economical in service than the two-cylinder superheater simples of the 4-6-0 type they have superseded.

In concluding it may be interesting to note that tests have been carried out on several French lines with engines belonging to other companies. The French lines are now in possession of a sufficient number of "Pacifics," and the total number of engines of this class now running is about 1,200. The latest series comprises 50 machines for the Nord. The particulars of these machines have not yet been made public.

It is contemplated to run all-steel trains on the main lines and the first all-steel car, weighing 45 tons, has just been delivered to the Alsace-Lorraine Railway. The weight of express trains will therefore be increased to about 600 tons and designs for a 4-8-2 express locomotive are being prepared: the grate area of these engines will be 55 square ft. and the driving wheels will measure 6 ft. $0\frac{3}{4}$ in. diam.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

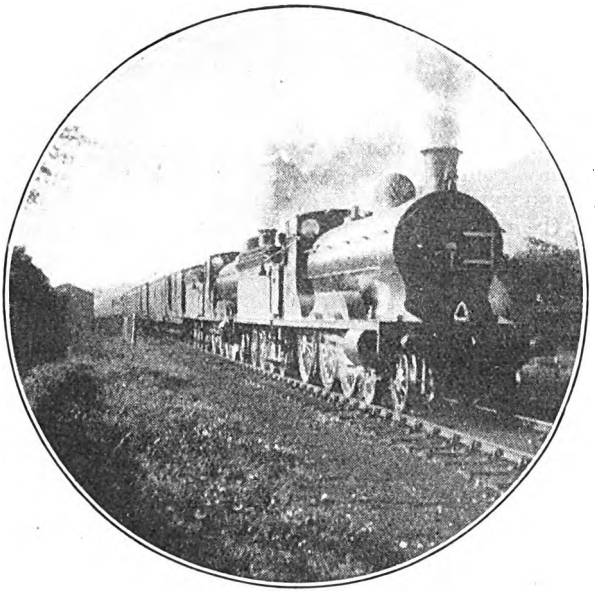

Photo.] [*A. B. Noble.*

LONDON MIDLAND AND SCOTTISH RAILWAY.

Perth-Inverness express near Aviemore.
Highland 4–6–0 locomotives Nos. 143 "Gordon Castle" and 146 "Skibo Castle."

AN enquiry which took place recently before the National Wages Board in connection with proposed alterations in railway scales of pay was productive of one of the most extraordinary statements in regard to locomotive working that I have ever heard made. We were told by an expert witness that the new express engines of the Great Western Railway, running at the rate of 83 miles an hour on some parts of the journey, would consume 50 lb. of coal per mile. By way of deduction, the speaker then assumed that if the fireman took up 2 lb. of coal on his shovel each time, it meant that when the train was going at that speed he would have to use his shovel 2,075 times an hour. If the train travelled at the rate of 64 miles an hour for the whole journey—which, he claimed, was what actually occurred—the fireman would have to use his shovel 1,600 times every hour. This evidence was in support of the contention that the work of the locomotive men had become 140 per cent. more exacting on account of larger engines, greater speed, and bigger loads. This statement was afterwards corrected to 4 lb. of coal per shovel, but the "amendment"—which, by the way, received in the daily newspapers the merest fraction of the notice they had bestowed on the original statement—in but little degree modified the original claim.

That the average physical labour of a fireman does not grow lighter under modern operating conditions is hardly a matter for dispute, but in what degree the advocacy of his case can be helped by so gross and, indeed, so perfectly ridiculous an exaggeration of the facts as this is a mystery indeed. In the first place, the fireman who puts his coal on the firegrate in 2-lb., or even 4-lb. numbers would appear to be qualifying for immediate admission to some institution catering for the mentally weak. In the second place, supposing we allow the amended 4-lb. in our calculations, 1,038 times per hour represents 17 times per minute and more than once every four seconds. If any human being could be discovered capable of taking a shovelful of coal from the tender, traversing it through some 6 ft. or so to the firehole door, depositing it in a suitable position in the firebox, withdrawing the shovel again and return

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ing it to the "ready," all within the space of four seconds, and not only so, but repeating the dose more than 15 times per minute by the hour together—well, the least that could be said is that he would command a far higher rate of remuneration in some Cinquevalli turn on the music-hall stage that ever he could dream of on the footplate!

The fact of the matter is that the footplate shovelful of coal is, on the average, round about 9 lb. and not 2 or 4 lb., and frequently larger amounts, up to 12 lb. and 13 lb., are taken on the shovel as a matter of habit. Then, again, such a speed as 83 m.p.h. is rarely more than momentary, even on the Great Western Railway, and it would be absurd to take such a rate of travel as a basis of estimation of coal consumption, which, further, does not reach its maximum on the high speed stretches of line, but where the greatest demands are being made on tractive power, that is, on the adverse gradients. Yet again, there is no train in the country scheduled at an average speed of as much as 64 m.p.h., and the number at over 60 m.p.h., the majority for comparatively short distances, can be counted on the fingers. It is a matter of common knowledge to most of my readers that an average of as much as 55 m.p.h. to represent overall British running speeds over long distances would be on the high side. For the sake of argument, however, we will take 55 m.p.h. as our basis figure.

Now the Great Western locomotive authorities, I believe, estimate their general average coal consumption with the large 4-6-0 engines at somewhere about

SOUTHERN RAILWAY (SOUTH WESTERN SECTION), WATERLOO–SALISBURY.

Distance.	Engine No. .. / Driver .. .. / Load (axles) / ,, (tons tare) / ,, (tons full)	Schedule.	748 U Knight 32 230 245	748 U — 44 303 320	740 U Hancock 44 308 325	Distance.	Schedule.	740 U Cocker 28 197 210	446 D Payne 32 234 245	743 U — 32 234 245
Miles.		min.	m. s.	m. s.	m. s.	Miles	min.	m. s.	m. s.	m. s.
0·0	Waterloo ..	0	0·00	0·00	0·00	83·8	93	96·59	94·03	fog.
								sig. stop	sigs.	
1·4	Vauxhall ..	—	3·30	3·30	3·34	82·4	89	91·23	90·02	fog.
3·9	Clapham Junc.	7	7·00	7·15	7·22	79·9	85	87·45	86·25	85·55
								sig. stop		
7·3	Wimbledon ..	—	11·00	11·35	11·55	76·5	—	79·22	82·17	82·00
								sigs.	sigs.	sigs.
12·1	Surbiton ..	—	16·00	16·55	17·38	71·7	—	72·42	76·50	77·10
									sigs.	
19·2	Weybridge ..	—	23·00	24·10	25·17	64·6	—	66·03	67·55	70·20
24·4	Woking ..	29	28·10	29·45	31·04	59·4	65	61·32	63·24	65·35
31·0	Mile-post 31 ..	—	35·20	37·55	39·32	52·8	—	55·23	57·20	sigs.
36·6	Fleet	—	40·40	44·00	45·40	47·2	—	50·08	51·56	52·15
42·3	Hook	—	46·10	50·10	51·52	41·5	—	45·03	46·44	47·00
47·9	Basingstoke ..	56	51·30	56·10	57·50	35·9	43	40·23	41·55	42·15
50·4	Worting Junc. ..	59	54·20	59·10	60·59	33·4	—	38·13	39·45	40·00
			eased							
55·7	Overton.. ..	—	60·30	65·25	67·18	28·1	—	32·48	34·39	34·15
61·2	Hurstbourne ..	—	66·20	70·35	72·38	22·6	—	26·58	29·15	28·10
			p.w.r.							
66·4	Andover Junc. ..	76	71·50	74·55	77·07	17·4	23	21·20	24·32	22·40
72·8	Grateley ..	—	80·30	81·05	83·32	11·0	—	15·44	19·05	17·05
78·3	Porton	—	86·20	87·05	89·35	5·5	—	9·00	10·24	9·35
82·7	Tunnel Junc. ..	—	90·00	91·00	93·07	1·1	—	3·04	3·33	3·45
83·8	Salisbury ..	93	92·15	93·10	95·25	0·0	0	0·00	0·00	0·00
83·8	Net times (min.)	93	88½	93¼	*95½	83·8	93	86¾	88¾	91

U: Urie 6-ft. 7-in. 2-cylinder 4-6-0. D: Drummond superheated 6-ft. 7-in. 4-cylinder 4-6-0.
* Schedule: 94 min.

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38 lb. per mile. I do not know whether this includes lighting up and time standing, but in order to present the case quite fairly we will assume not; this exclusion will tend, anyway, to balance the fact that on the Great Western Railway the best Welsh coal is used of very high calorific value. Taking, then, an average of 38 lb. per mile, at 55 m.p.h., in 9-lb. instalments, we have, not 2,075 shovelfuls per hour, nor even 1,038, but 232! Not one shovelful every four seconds, but less than four per minute! And what generally happens, as most of my readers know, is that the fire-hole door is opened and half-a-dozen or more large shovelfuls

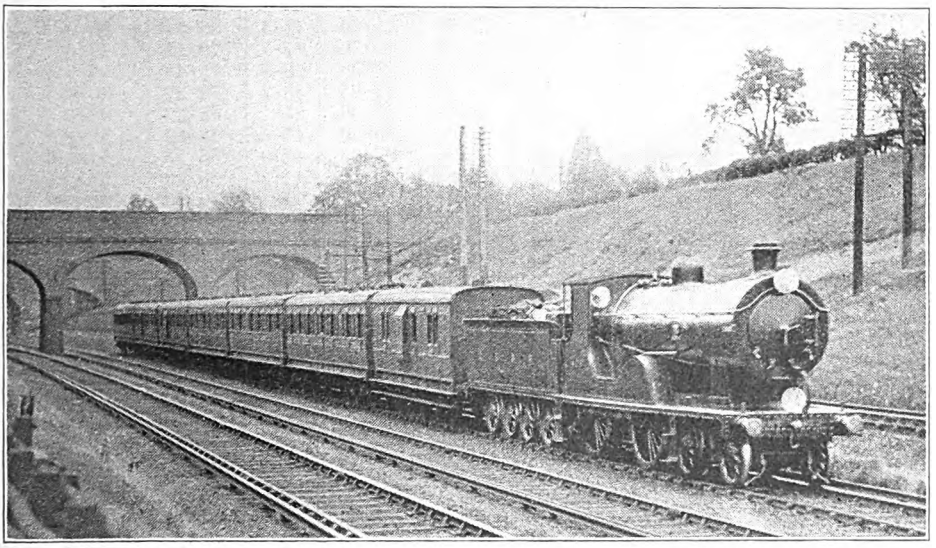

Photo.] SOUTHERN RAILWAY. [*F. E. Mackay*

Waterloo-Salisbury train. London & South Western rebuilt 4–4–0 locomotive No. 423.

are put on in succession, after which the fireman has a rest of a couple of minutes or so before attending to the fire again. The actual rate of firing is dependent, of course, on the relative arduousness of the work which the locomotive is called upon to perform, and varies with every train and every stretch of line. I have travelled on the footplate over some 31 miles of line continuously, that is, for over half-an-hour, without the fire being so much as touched, and although I grant that this was from Shap Summit down to Carlisle, the stretch of line concerned is by no means exclusively downhill, and the train concerned was on the fastest schedule of the day. Reverting to the Great Western Railway, I know for a fact that the 4-6-0 engines frequently run on such turns as the Bristol 2-hour trains for 10 miles or so without attention to the fire.

Most railways have some turns of duty on which the difficulty of firing is in excess of the average. As cases in point one might take the non-stop Plymouth journey of the Great Western *Riviera Limited*, the through London-Manchester working of a 4-4-0 *Director* for 4½ hours on the 3.20 p.m. London and North Eastern (Great Central) express out of Marylebone, such Great Northern "Pacific" duties as the immensely hard 5.45 p.m. out of King's Cross and the express arriving at 1.55 p.m., and on the Great Eastern section of the same group the brief but exacting 82-min. run of the 8.30 p.m. and 8.40 p.m. Continental boat expresses from Liverpool Street to Parkeston Quay. But such duties are, after all, in the minority. And nothing was said, in the presentation of this case, of the vast increases in locomotive efficiency which have accompanied the provision of the "larger engines," and whereby the 140 per cent. increase in combined speed and loads (if this figure has any foundation in fact) is borne

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chiefly by the engine herself, rather than being passed on to the crew in the shape of more arduous labour. The worst of silly arguments such as the one with which I have just dealt is that our newspapers, as usual, give them prominence and adorn them with heavily-leaded headlines, with the result that the unfortunate public, who are not in a position to know anything different, accept the "truths" thus presented, and give them their complete credence.

I had hoped in the present article to find space for the discussion of two letters from correspondents, one in the far-away Argentine, dealing with the future development of express locomotive design in this country, and to illustrate the discussion with drawings representing the suggestions of these writers; but I must postpone this matter until next month, in order that I may have space in the present issue sufficient to describe my recent experiences on the South Western section of the Southern Railway. To my own journeys there have been added certain runs for which I am indebted to the kindness of three correspondents, the care exercised in whose work of record is evident in the detailed manner with which their logs have been framed. For myself, in making three return journeys on quite

SOUTHERN RAILWAY (SOUTH WESTERN SECTION), SALISBURY-EXETER.

Distance.	Engine No. .. / Driver .. .. / Load (axles) .. / ,, (tons tare) / ,, (tons full)	113 D Bailey 32 225 240	748 U Butler 32 230 245	744 U Butler — 289 310	748 U — 44 303 320	Distance.	703 D Burridge 32 227 240	Distance.	745 U Cooper — 394 415
Miles.		m. s.	m. s.	m. s.	m. s.	miles	m. s.	miles	m. s.
0·0	Salisbury ..	0·00	0·00	0·00	0·00	75·8	88·22	88·0	104·10
2·4	Wilton	5·40	5·00	5·53	5·20	73·4	85·01	85·6	100·41
8·1	Dinton	12·30	11·30	13·02	12·20	67·7	79·41	79·9	95·30
12·3	Tisbury ..	17·45	16·15	18·03	17·25	63·5	75·48	75·7	91·42
17·6	Semley	24·00	22·05	24·10	23·35	58·2	70·32	70·4	86·31
21·7	Gillingham ..	27·45	26·05	28·18	27·30	54·1	65·20	66·3	81·25
28·2	Templecombe ..	33·40	32·15	35·00	33·50	47·6	58·50	59·8	74·52
30·9	Milborne Port ..	36·45	35·05	38·08	37·05	44·9	55·53	57·1	71·57
34·2	Sherborne ..	40·10	38·20	41·49	40·10	41·6	50·43	53·8	66·38
38·7	Yeovil Junc. ..	43·50	42·10	46·12	44·35	37·1	46·20	49·3	62·10
42·5	Mile-post 126¼ ..	47·35	45·55 p.w.r.	50·25	48·50	†34·7	†44·23	†46·9	†60·15
47·6	Crewkerne ..	52·40	51·50	55·54	54·25	28·2	38·27	40·4	54·20
49·2	Mile-post 133 ..	55·10	54·05	58·30	57·00	26·6	36·43	38·8	52·37
55·7	Chard Junc. ..	61·30	60·10	65·21	63·40 p.w.r.	20·1	27·48	32·3	43·43
60·8	Axminster ..	65·30	64·10	69·55	69·15	15·0	20·32 sigs.	27·2	37·31
64·0	Seaton Junc. ..	68·10	67·05	72·53	72·25	11·8	17·33	24·0	34·32
66·7	Mile-post 150½ ..	71·55	70·50	77·04	76·45	9·1	p.w.r.	21·3	p.w.r.
68·7	,, 152½ ..	76·10	74·25	81·32	80·45	7·1	12·45	19·3	29·26
69·7	,, 153½ ..	78·15	76·05	83·41	82·40	6·1	10·41	18·3	27·38
70·9	Honiton ..	79·45	77·35 eased	85·17 p.w.r.	84·10	4·9	8·28	17·1	25·15
75·8	Sidmouth Junc.	83·30	83·35	90·22	88·30	12·2	17·55	12·2	18·30
79·2	Whimple ..	86·25	5·20	94·05	92·10	8·8	12·01	8·8	12·41
82·8	Broad Clyst ..	89·15	8·10	97·25	95·25	5·2	7·50	5·2	8·22
86·5	Exmouth Junc.	92·35	11·45 sig. stop	101·22	99·30	1·5	3·30	1·5	3·48
88·0	Exeter	94·40	15·30	103·38	102·00	0·0	0·00	0·0	0·00
88·0	Net times (min.)	94¾	*91½	102½	100	88·0	18+85½	88·0	103

D: Drummond small 6-ft. 7-in. 4-4-0 without water-tube firebox.
U: 6-ft. 7-in. Urie 2-cylinder 4-6-0.
* Estimated on non-stop basis, Salisbury–Exeter. † Sutton Bingham Station.

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casual occasions, I have been exceedingly fortunate in securing records, on both the Bournemouth and Exeter routes, which, in certain of their features, embodied some of the fastest South Western locomotive work that I have ever noted. I had no conversation with the drivers concerned, and, so far as I am aware, they had no knowledge whatever that their work was under observation. So casual was my chief Exeter journey, indeed, that I waited until the last day of availability of the facilities which I held, and then made a hurried decision to travel by the ordinary service. We were doing 50 m.p.h. at Clapham and 54 at Wimbledon, despite the rise between the two places; then we got up to 61 on the level at Surbiton, 65 on the faint descent to Esher, and after falling to 59 on the faint rise past Walton, the 1¼ miles at 1 in 330 past Weybridge brought us up to 66 m.p.h. The 10½-mile ascent from Byfleet Junction to mile-post 31 only brought us down to 55½ m.p.h., although it steepens gradually from 1 in 386 to 1 in 300, on which we steadily maintained the rate last mentioned. The next 6 miles are nothing

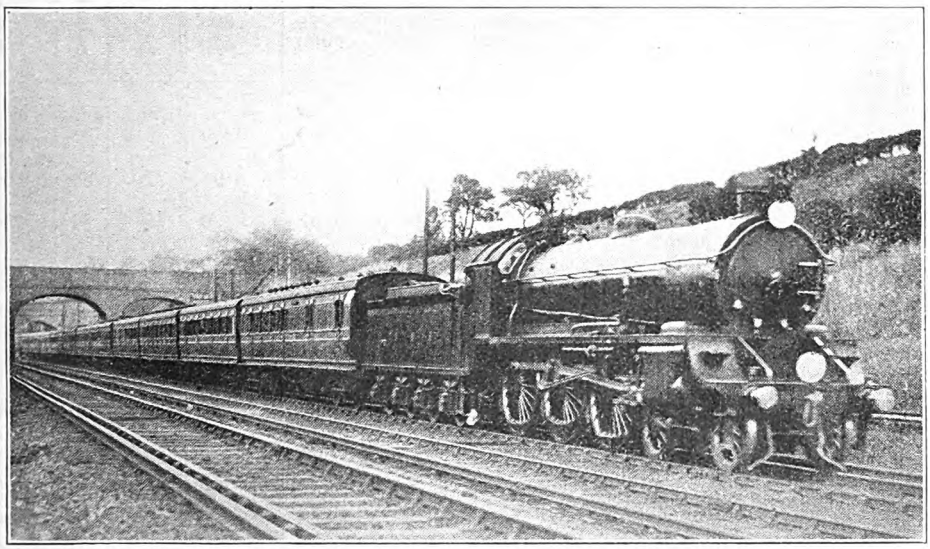

Photo.] **SOUTHERN RAILWAY.** *[F. E. Mackay.*

Down West of England Restaurant Car Express.
London & South Western 4-6-0 locomotive No. 736.

11 a.m. down, with startling results, as we shall see in a moment.

The first table deals with runs between Waterloo and Salisbury, of which that in the first column is the run just referred to; after this follow two runs on the same train with the summer loading, one of my own, and the other timed by a correspondent. Of the up runs, the first two were timed by friends, and the third, on the 4.36 p.m. up, by myself. The feature of Knight's effort in the first column was the extraordinary time of 51½ min. out to Basingstoke—certainly my own record, and to the best of my recollection the fastest I have ever seen recorded in easier than level, but we mounted to 65 m.p.h.; 3 miles at 1 in 337 past Winchfield did not suffice to bring us below 62½; the brief mile down at 1 in 386 after Hook brought us up to 67; and 4¾ miles up to Battledown Box at 1 in 249 gave a final minimum of 52½ m.p.h.

Thus to maintain an average speed of exactly 60 m.p.h. from Surbiton to Worting, over a route of which 23½ miles are uphill and 11½ level out of 38¼ miles in all, struck me as a notable piece of work. After that we were very materially eased, but the engine was opened out again after the Andover slack, and commencing the 4½ miles at 1 in 264-165 to Grateley at

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53 m.p.h., we finished them at 46, and touching 76½ on Porton bank, we came to a stand at Salisbury over a minute inside time, despite a slow stop drawing up to the water column. The net time of 88½ min. cited is based on the loss by the Andover slack only; although 4½ min. under schedule, it could obviously have been cut further with great ease by a some style, reaching 60 at Whitchurch, 72½ at Hurstbourne "dip," and a momentary 80½ before Andover—the first time I have recorded an "eighty" with this type. But after a minimum of 45½ at Grateley we descended Porton bank chiefly at 69 m.p.h., only touching 74 briefly near the foot, so just keeping time. No. 740 touched 74 at Andover, fell to

SOUTHERN RAILWAY (SOUTH WESTERN SECTION), WATERLOO–SOUTHAMPTON.

Distance.	Engine 4-4-0 No.	Schedule.	419 d	* 300	463 D & 740 U	472 D	471 D	Distance.	Schedule.	470 D
	Driver		—	Luke	Harding	—	Penton			Bullard
	Load (axles) ..		36	48	—	52	—			—
	,, (tons tare)		280	368	377	379	395			416
	,, (tons full)		300	385	400	400	420			440
Miles.		min.	m. s.	m. s.	m. s.	m. s.	m. s.	miles	min.	m. s.
0·0	Waterloo ..	0	0·00	0·00	0·00	0·00	0·00	79·3	92	96·40
										sig. stop
1·4	Vauxhall ..	—	sigs.	3·41	3·14	3·51	4·00	77·9	88	91·07
							sigs.			
3·9	Clapham Junc...	7	10·10	7·22	6·30	7·42	9·23	75·4	84	87·46
							sigs.			
7·3	Wimbledon ..	—	sigs.	11·37	10·21	12·16	15·12	72·0	—	83·56
							sigs.			
12·1	Surbiton ..	—	20·00	16·51	15·21	17·49	23·15	67·2	—	78·30
					sigs.					
19·2	Weybridge ..	—	28·00	24·35	23·41	25·30	31·33	60·1	—	71·21
			p.w.r.							
24·4	Woking ..	29	34·55	30·11	28·42	31·25	37·12	54·9	64	66·38
31·0	Mile-post 31 ..	—	43·15	38·14	36·34	40·39	45·24	48·3	—	60·29
36·6	Fleet	—	49·05	44·12	42·11	47·15	51·35	42·7	—	54·57
42·3	Hook	—	54·50	50·07	47·38	53·39	57·34	37·0	—	49·41
47·9	Basingstoke ..	56	60·20	56·02	52·57	59·47	63·33	31·4	42	44·44
50·4	Worting Junc.	—	63·15	59·12	55·45	62·58	66·37	28·9	—	42·24
56·2	Litchfield Box ..	—	69·55	66·51	62·45	70·58	74·25	23·1	—	35·42
58·2	Micheldever ..	—	71·40	68·48	64·35	72·56	76·22	21·1	—	32·38
66·7	Winchester ..	—	78·35	76·45	71·44	80·54	83·45	12·6	—	20·16
73·6	Eastleigh ..	83	84·00	82·48	77·28	86·53	89·43	5·7	10	10·42
78·2	Northam Junc.	88½	88·15	87·22	82·54	91·04	sig. stop	1·1	3½	—
				sig. stop		sigs.				
79·3	Southampton W.	92	90·50	95·02	86·04	94·31	106·29	0·0	0	0·00
79·3	Net times (min.)	92	85	90	84¾	93¾	90	79·3	92	95

D: Latest Drummond type, superheated. d: Large-boilered Drummond type, superheated.
* Small-boilered Drummond type, superheated. U: 4-6-0 2-cylinder Urie type.

continuation of the Waterloo-Worting effort.

The next two runs were quite ordinary by comparison. Speeds were 51 and 50 m.p.h. at Wimbledon, 61½ and 60 at Byfleet Junction, 52½ and 49½ at Woking, 47½ and 45 at mile-post 31, 60 and 59 beyond Hook, and 47½ and 46 at Battledown; after this No. 748 got away in 45 at Grateley, and reached 79 on Porton bank; schedule in this case was a special one of 94 min., owing to a division of the train, and was not quite maintained.

In the up direction the fine run shown behind Driver Cocker, with No. 740, was beaten in its early stages by a finer one which I enjoyed behind the same driver, on No. 751, with a much heavier 36-axle

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load of 270 tons. On this run we passed Tunnel Junction in 3¼ min. and Porton in 8¾ min., accelerating to 49½ m.p.h. and then dropping back to 48 on the 1 in 169, and only falling to 46 on the 1 in 140, while on the 1 in 245 to Amesbury Junction we worked up to 52½, and up the ensuing 1 in 735-440 to Grateley to 57½ m.p.h. The total length of this bank is 9½ miles, of which the steepest part is 2½ miles at 1 in 169, 1¼ at 140 and 1¾ at 245, Porton being on the middle 140. Descending to Andover, we touched 75 m.p.h., then fell to 55½ up the 3¼ miles following at 1 in 178; Hurstbourne heating, and so we had to stop at Basingstoke (in 39 min. 50 sec. from Salisbury, 35·9 miles, after a preliminary signal check) to detach the offending vehicle. This was to me a great disappointment, as, knowing the record of Driver Cocker as I do, I felt sure we were in for an exceptional trip. As it was, in order to save time I changed into the immediately following Bournemouth train, whereon No. 751 made a very fair run to Surbiton, 35·8 miles, in 38 min. 35 sec., start-to-stop, with maxima of 70½ m.p.h. at Woking and 67 at Walton.

The first of the three up journeys, on

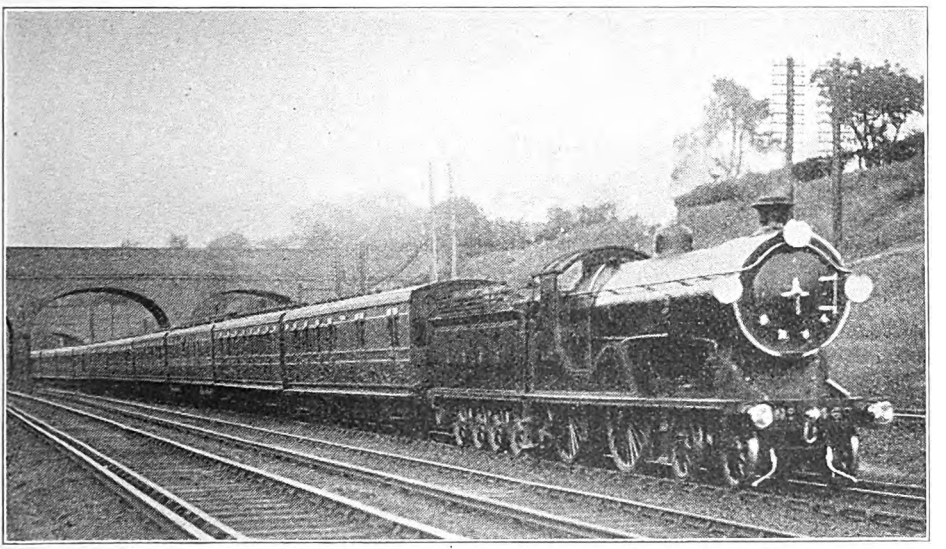

Photo.] SOUTHERN RAILWAY. [*F. E. Mackay.*

Down Bournemouth Restaurant Car Express.
London & South Western rebuilt 4-4-0 locomotive No. 467.

"dip" brought us up to 64½ and down again to 59 m.p.h., after which we maintained steadily a speed of 60-61½ right up the 1 in 550 which extends for 6½ miles from Whitchurch to Oakley.

As a result of this really magnificent running we passed Grateley in 15 min. 10 sec., Andover in 20¾ min., Hurstbourne in 26 min., Overton in 31 min. 35 sec., and Worting Junction in 36 min. 55 sec., with excellent prospects of passing Basingstoke in 39 min. (a gain of 4 min. on schedule after a late start), and of achieving "even time" later on in the journey. But it was not to be. An axle-box on the leading coach began to display serious signs of which Cocker was again the presiding genius, was quite good, but the load was much lighter. Speeds were 75 m.p.h. before Andover, 50 minimum before Hurstbourne, and a gradual acceleration to 60 at Overton; then 76½ beyond Basingstoke, falling away to 59 at mile-post 31; and 72½ beyond Woking. With the times of the run last described as far as Worting, added to these from Worting to Surbiton, the latter station, 71·7 miles, would have been passed in 71 min. 20 sec.; as it was, "even time" was within measurable distance of realisation had it not been for the usual succession of checks in the London area.

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On the next two runs one of the rebuilt 4-cylinder Drummond engines was matched against a 4-6-0 of the Urie type, with identical loads. The former did poorly up to Grateley, falling to 31½ m.p.h. on Porton bank against 743's minimum of 40; but then the positions were absolutely reversed, the maxima at Andover being 79 and 75 m.p.h., the minima before Hurstbourne 59 and 51 m.p.h., and the maintained speeds up to Oakley 64 against 55 m.p.h.—in fact, No. 446's time of 17 min. 23 sec. for the 18·5 miles from Andover to Basingstoke was remarkable altogether. Speeds were 76½ and 74 m.p.h. beyond Basingstoke; No. 743 passed Farnborough at 65 m.p.h., but then got signals on, while No. 446 passed mile-post 31 at 57½ m.p.h.; then followed 71½ and 70½ m.p.h. beyond Woking, and the usual concluding delays on both runs. As regards these up runs it may be noted that No. 740 covered the 60·7 miles from Grateley to Surbiton in 56 min. 58 sec., and No. 446 reeled off the 53·6 miles from Grateley to Weybridge in 48 min. 50 sec., the latter representing an average speed of all but 66 m.p.h. for over 50 miles.

And now for the Salisbury-Exeter journeys. The profile of this mountainous route appeared in my November, 1921, article, which was doubtless sufficiently recent for most readers to have it ready to hand. In the first column is tabulated my memorable run with Bailey on No. 113—a Drummond early 4-4-0—which I have shown alongside Butler's effort on No. 748, the latter continuing the remarkable achievement of Knight with the same engine between Waterloo and Salisbury. The third down journey was timed by a correspondent and the last by myself, Nos. 2, 3 and 4 representing one winter and two summer trips on the 11 a.m. down.

By comparing the details of the first and second runs with the profile, it will be seen at once that No. 748 beat the 4-4-0 on all the up grades, as is, of course, to be expected, while the 4-4-0 was slightly the faster downhill. This is not to say, however, that the 4-6-0 was unwilling to show her paces, as we worked up to three "eighties" in a distance of less than 50 miles, 80½ being reached at Sherborne, at Chard Junction and also at Broad Clyst, while we attained 71½ at Gillingham (this was the only bank as far as Honiton on which we slackened severely), 77½ before Templecombe, and kept up 76½–77½ most of the way from Chard Junction to the foot of Colyton bank, beyond Axminster.

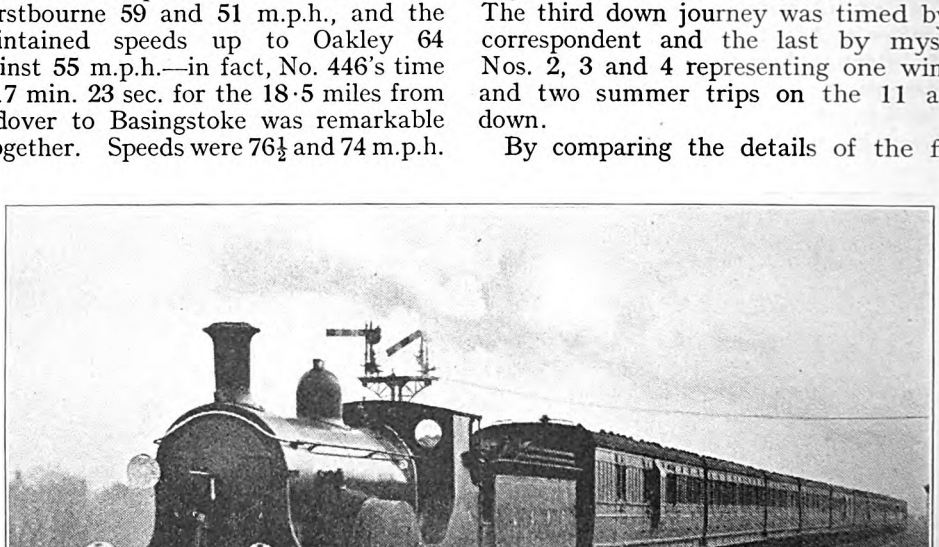

Photo.] SOUTHERN RAILWAY. [*F. E. Mackay.*

Down Portsmouth express. London & South Western 4-4-0 locomotive No. 312.

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From Honiton Tunnel down to Sidmouth Junction, however, we did not so much as touch 60 an hour, time being so well in hand. By contrast No. 113 was doing 77½ m.p.h. at Gillingham, 76½ before Templecombe, 80½ at Sherborne, and 80 at Axminster, while 82 m.p.h. was the maximum reached before Sidmouth Junction and 86½ was touched at Broad Clyst.

But look at the comparison between 113 and 748 on the up grades: the respective minima were 43 and 48 m.p.h. at Semley (the latter engine sustained 60 for several miles between Wilton and Dinton on gradually rising grades); 44 whereas No. 113 was going pretty well "all out" for most of the distance. Even so, had No. 748 achieved No. 113's times from Honiton into Exeter, which from her previous speed exhibitions was easily possible, Exeter would have been reached in 92½ min. from Salisbury, or in 91½ min., allowing for the p.w.r. check at Hardington, near Crewkerne. With equally fast downhill work on all down grades a time of 90 min. would probably have been possible. Adding these times to the previous achievements of the same engine between Waterloo and Salisbury, we see with what perfect ease—provided that

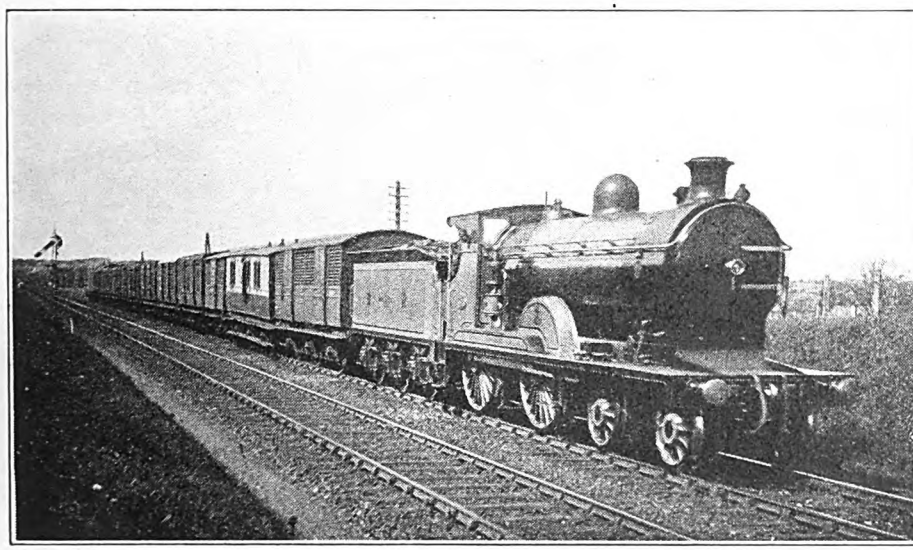

Photo.] **LONDON MIDLAND AND SCOTTISH RAILWAY.** [*Henry L. Salmon.*

Aberdeen and South fish train near Perth. Caledonian 4-4-0 locomotive No. 71.

and 47½ at mile-post 113½ beyond Templecombe (after 2½ miles at 1 in 80–100); 51 and 52½ at mile-post 126¼, beyond Sutton Bingham; 34½ and 38 at mile-post 133, near Hewish Gates (after 2¾ miles at 1 in 80); and then 26 and 34 m.p.h.—a notable difference here—after climbing the 6¼ miles of Colyton bank, mostly at 1 in 80, to mile-post 152½. No. 748 *accelerated* to this figure after having fallen to 33 m.p.h., and further to 37½ on the mile at 1 in 132 through the summit tunnel.

More notable differences in uphill work might have been noted were it not that No. 748 was being driven under easy steam, water-troughs were laid down—the Southern Railway could, with these fine engines, equal the Great Western three-hour schedule to Exeter. On this particular run I should put the equivalent net non-stop time at 177 min. for the 171·8 miles, proportioned as follows: to Basingstoke 51½ min.; Andover, 70 min.; Salisbury (pass slowly), 87 min.; Templecombe, 118 min.; Yeovil Junction, 128 min.; mile-post 133, 139 min.; mile-post 153½, 161 min.; Sidmouth Junction, 166 min.; and Exeter, 177 min. Thus 3 hours would allow a small margin for possible delays *en route*, as in addition to this 3 min. the engine had plenty of

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power in reserve for use if required. From Sidmouth Junction we passed Exmouth Junction, 10·7 miles, in 11¾ min., having touched 80½ m.p.h. for a third time at Broad Clyst, but were prevented from achieving a smart start-to-stop time of 14 min. to Exeter, 12·2 miles, by a brief signal stop outside. This was throughout a most exhilarating journey, and bettered the best of my pre-war experiences.

The other two down runs may be dismissed briefly. Nos. 744 and 748 achieved respective maxima of 53½ and 56½ m.p.h. at Dinton, 69 and 76½ at Gillingham, 66 and 77½ at Sherborne, 69 and 72½ on the descent from Hewish to Axminster, and 68 and 74 in descending from Honiton to Broad Clyst, No. 744 being thus very severely restrained in regard to downhill speeds. Uphill, however, the differences were very small, the minima being 41½ and 43½ m.p.h. at Semley, 41½ and 40 at mile-post 113½, 45 and 43½ at mile-post 126¼, 31 and 32 at mile-post 133, and, finally, 26 and 30½ at the 152½ mile-post, which marks the top of the steepest section of Colyton bank. Actually speed fell to a shade below 30 m.p.h. on the short 1 in 70 in the latter case, but recovered to the figure mentioned, and further to 34 at mile-post 153½. After the Axminster check No. 748 accelerated to 70½ m.p.h. before commencing the ascent of Colyton bank. The latter run was on a schedule of 101 min. to Exeter, passing Templecombe in 32 min., Yeovil in 43 min., and Sidmouth Junction in 88 min., but the former train was booked from Salisbury to Exeter in 104 min.

Of the up runs, both recorded by a correspondent, the first was timed on the fastest and hardest of all the up timings—the 10.30 a.m. from Exeter—which includes a 2-min. stop at Sidmouth Junction in a booking of 104 min., and is equivalent to a non-stop run in something like 99 min., while the second was on the 12.30 p.m., allowed 102 min., with the biggest single-headed load—415 tons—that I have ever known over this road. Speeds on Whimple bank—5¾ miles at 1 in 170–100—dropped from 67 and 64½ to 33½ and 31½ m.p.h., and the 4½ miles at 1 in 100 (chiefly)-90 past Honiton resulted in minima of 29½ and 29 m.p.h. Down Colyton bank maxima of 80½ and 71½ m.p.h. were recorded, in both cases after a p.w.r. check, and No. 703, in addition, suffered adverse signals at Axminster. Up the

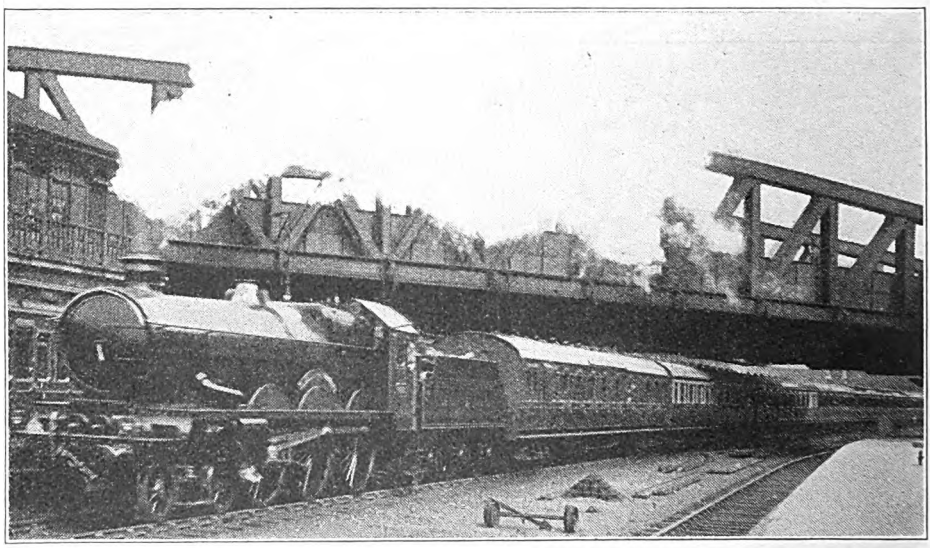

Photo.] GREAT WESTERN RAILWAY. [*F. E. Mackay.*

Cheltenham express leaving Paddington.
New four-cylinder 4-6-0 locomotive, No. 4073, "Caerphilly Castle."

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13-mile bank to Hewish the minima were 41 and 40½ m.p.h., up Sherborne bank 32½ and 32 m.p.h., and up the ascent to Semley 36½ and 37 m.p.h., with intervening maxima of 77½ m.p.h. in both cases on Crewkerne bank, of 79 and 75 m.p.h. at Templecombe, and of 68 and 70½ m.p.h. before the usual Wilton slack. In view of the disparity in the loads, the close correspondence of the two sets of times is very extraordinary, the maximum difference between Chard Junction and Salisbury only amounting to 25 sec. The big engine on the second of these up journeys gave ample evidence of her capabilities over such a road with a load of this magnitude, and no apologies need be made for the loss of a minute on schedule in these difficult circumstances.

I had one up run from Exeter to Salisbury in which No. 751 made an exceptionally fine start with 270 tons, touching 68 m.p.h. at Broad Clyst, and not falling below the really high minima of 41 and 39 m.p.h. on the two stages of the difficult ascent to Honiton Tunnel, so passing Exmouth Junction in 3 min. 20 sec., Broad Clyst in 7½ min., Whimple in 11 min. 40 sec., Sidmouth Junction in 16 min. 35 sec., Honiton in 22 min., and mile-post 153½ summit in 23 min. 50 sec. But speed was rigidly restrained down Colyton bank, and in addition we were badly checked for p.w. repairs at Axminster, so taking 41 min. 5 sec. to Chard Junction and 49 min. to mile-post 133 summit, which we passed at 45½ m.p.h. (after recovering from the slack to 53½ m.p.h. on the climb). After that the maxima were 77½ m.p.h. on Crewkerne bank and 75 at Yeovil Junction, and the minima 60 at mile-post 126¼ and 37½ on Sherborne bank, giving times of 58 min. 25 sec. to Yeovil Junction, 62¾ min. to Sherborne, 67 min. 35 sec. to Milborne Port, and 70 min. 55 sec., or 68 min. net, for the 59·8 miles to Templecombe, start-to-stop. This was excellent work, as the schedule for this run was 72 min. Checks, however, ruined the Templecombe-Salisbury stage.

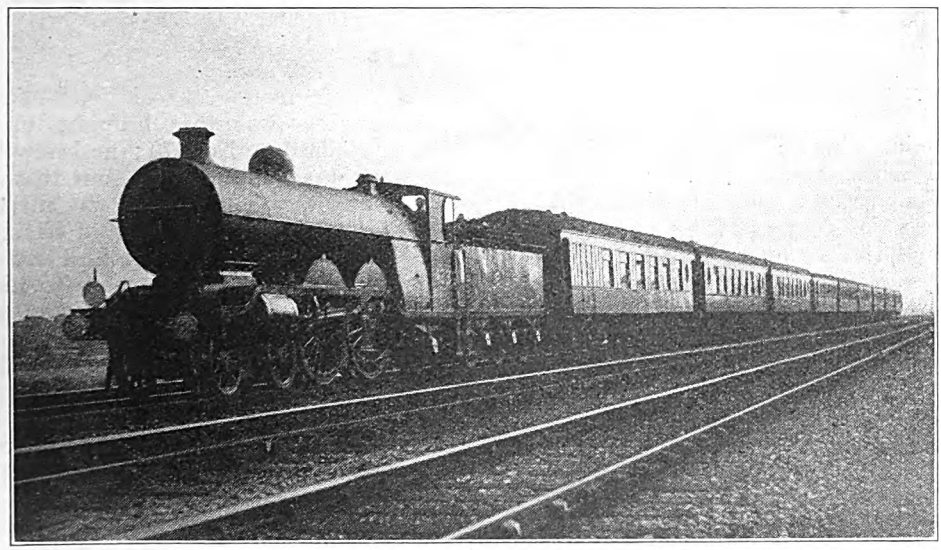

Photo.] SOUTHERN RAILWAY. [*O. J. Morris.*

Up afternoon "Southern Belle" (nine cars) near Salfords.
Brighton 4-4-2 locomotive No. 423.

And now, lastly, a brief word about the Southampton runs. The only run of my own is the first in the table, where No. 419, on a foggy day which badly delayed our start, ran so splendidly from Woking onwards as to pick up no less than 7 min. on schedule from there to Southampton. This was again quite a casual run, so far as I was concerned, and so far from having had any conversation with the driver, I am unfortunately unaware even of his

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name. The load consisted of nine bogies, five of the new wide stock, weighing 300 tons in all, and so was quite substantial. After the Byfleet check, which was severe and prolonged, we recovered to 46½ m.p.h. at Woking, and sustained 49 all the way from Brookwood to mile-post 31. Speed then varied between 64½ and 57½ m.p.h. nearly to Basingstoke, and the minimum beyond Battledown was exactly 50—a fine figure after 4½ miles up at 1 in 249. By Litchfield Tunnel we were doing 57½, and then followed a most bracing "flight" to Southampton, passing Micheldever at 69 m.p.h., Waller's Ash at 75, maintaining 77½ to 79 all the way from Winchester to Allbrook Junction, easing to 71½ through Eastleigh, and to 66 at St. Denys, where we slowed carefully for Northam Junction. Average speed over the 19·1 miles from Micheldever to St. Denys was 73·2 m.p.h., 5½ min. being gained between Basingstoke and Southampton alone.

The second run is of considerable interest as demonstrating the capacity of one of the recent superheater rebuilds of the small-boilered Drummond 4-4-0 class, No. 300 having to tackle the heavy 12-coach load of 385 tons, half of which was of the new wide stock. Maximum speeds were 57½ m.p.h. at Surbiton, 58 at Byfleet, 60 at Farnborough, and 69½ at Eastleigh, while the minima were 47½ at mile-post 31 and 42 beyond Battledown, and time would have been more than easily maintained but for the concluding signal check. The powerful combination of engines in the next column made light of their 400-ton train, although they did not, save in starting out to Surbiton, better the unaided work of No. 748 on my best Salisbury journey. Speeds were 64½ m.p.h. at Byfleet, 47½ at mile-post 31, 65 at Fleet, 63 at Hook, 66½ before Basingstoke, 45 beyond Battledown, and 75 was just reached on the descent past Winchester. Actually the run was made in 86 min., or 6 min. less than schedule; net time was about 84¾ min. It will be remembered that the pre-war allowance of the Bournemouth two-hour trains was 87½ min. to passing Southampton West, which these two engines and also No. 419 bettered substantially.

Then follow the efforts with tremendous trains of Nos. 472 and 471, of the largest Drummond 4-4-0 type now superheated. No. 472 touched 58 m.p.h. at Surbiton and 55½ at Byfleet, and No. 471, after the initial delays, attained 57 and 59 m.p.h.; thereafter the speeds were 40½ and 45 m.p.h. at mile-post 31, 55½ and 59½ before Basingstoke, 41 and 40½ after Battledown, and 68 and 74 in descending to Eastleigh. After allowing for delays, No. 472 lost the slight margin of 1¾ min. on schedule; but by the very fine work Driver Penton got out of No. 471 with this huge train, his net gain was 2 min.

An even more colossal load—for a 4-4-0 engine—was that brought up by Driver Bullard on No. 470; he knew that his work was being recorded, but this does not in any way detract from the merit of the work performed. A speed of 48 m.p.h. was attained at Eastleigh, and up the 16½ miles at 1 in 250 from there to Litchfield Tunnel speed fell very gradually to a minimum of 39½ from Micheldever onwards. From 60 m.p.h. at Battledown speed increased to 72½ below Basingstoke, and then ranged between 64½ and 57½ from there onwards to mile-post 31; after that 69 was reached at Byfleet Junction, and between 63½ and 59 was kept up until beyond Surbiton. It was creditable indeed in such circumstances to lose no more than 3 min. net from Southampton to Waterloo. Here I must conclude these notes.

It has been to me very pleasant to renew acquaintance with the old-time brilliance of South Western running, and if only the terminal working could be improved on the up journeys, as well as the working at certain intermediate stations—more particularly Salisbury and Exeter—South Western overall times might challenge comparison with the best of those achieved elsewhere in the country.

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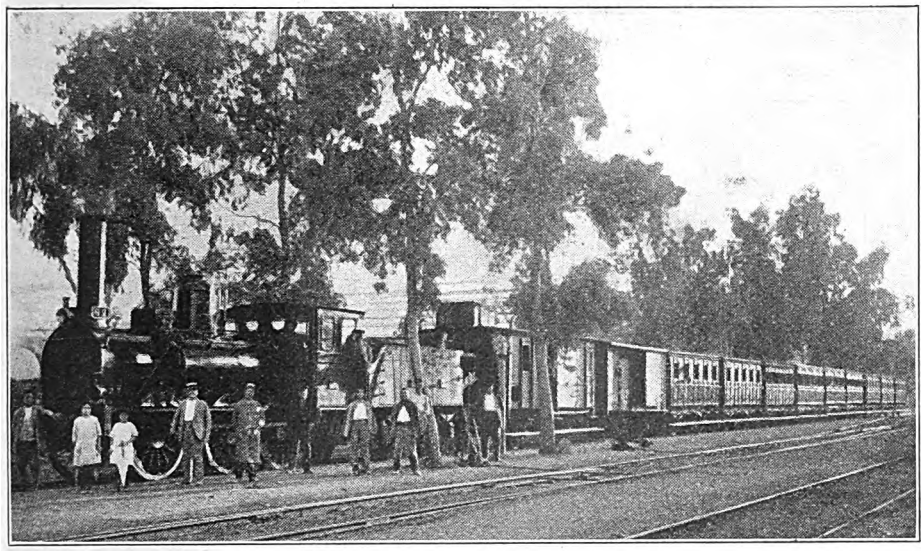

ALICANTE-MURCIA TRAIN.

The Mixed Train in Spain.

By GEORGE L. BOAG.

IMAGINE a bare, unroofed, gravel platform, raised only a few inches above the rails, a cloudless sky, and the vertical sunlight blazing down on a small white building. The long single line of rails and telegraph poles stretching away into a distant mirage at either end with no trees and no shade and no break in the yellow plain as far as the mountains on the horizon, except for the scarcely perceptible roofs of a village in the distance.

The "mixto" arrives; an aged, clanking engine, and a dozen wagons, with a couple of old-fashioned carriages in the rear. As this striking convoy deliberately comes to rest, the three or four passengers descend and greet an equal number of waiting villagers, while women come with earthern jars for water from the locomotive. The stationmaster and the guard exchange news and cigarettes, the porter and brakesman discharge sacks and boxes, and in course of time the engine whistles, the passengers climb into the carriages, and the "mixto" leaves, marking the passing of another day.

Such is the mixed train and its mission in a sparsely-populated country of long distances. Perhaps fortunately for him, the English traveller rarely has occasion to journey on these trains, but they serve their purpose as an economical means of transport on local lines of reduced traffic density.

Some of the mixed trains on the main trunk lines have almost acquired, in the course of years of increasing traffic, the dignity of regular passenger trains, and are run with continuous brakes, the merchandise portion of the traffic being limited to "smalls" and through vans fitted with brake pipe. Others are really slow goods trains with advertised passenger accommodation limited to a given number of third-class seats. Between the two limits there are many different grades of accommodation, speeds, &c.

Of the better class mixed train, a good example is the "mixto" de Andalucia, which leaves Atocha station in Madrid at 7.20 a.m. with carriages of all three classes and reaches Seville at 7.40 the following morning—a journey of over 24 hours, for 356 miles, at a "commercial" speed of 15 miles an hour, and no less than 70 stops,

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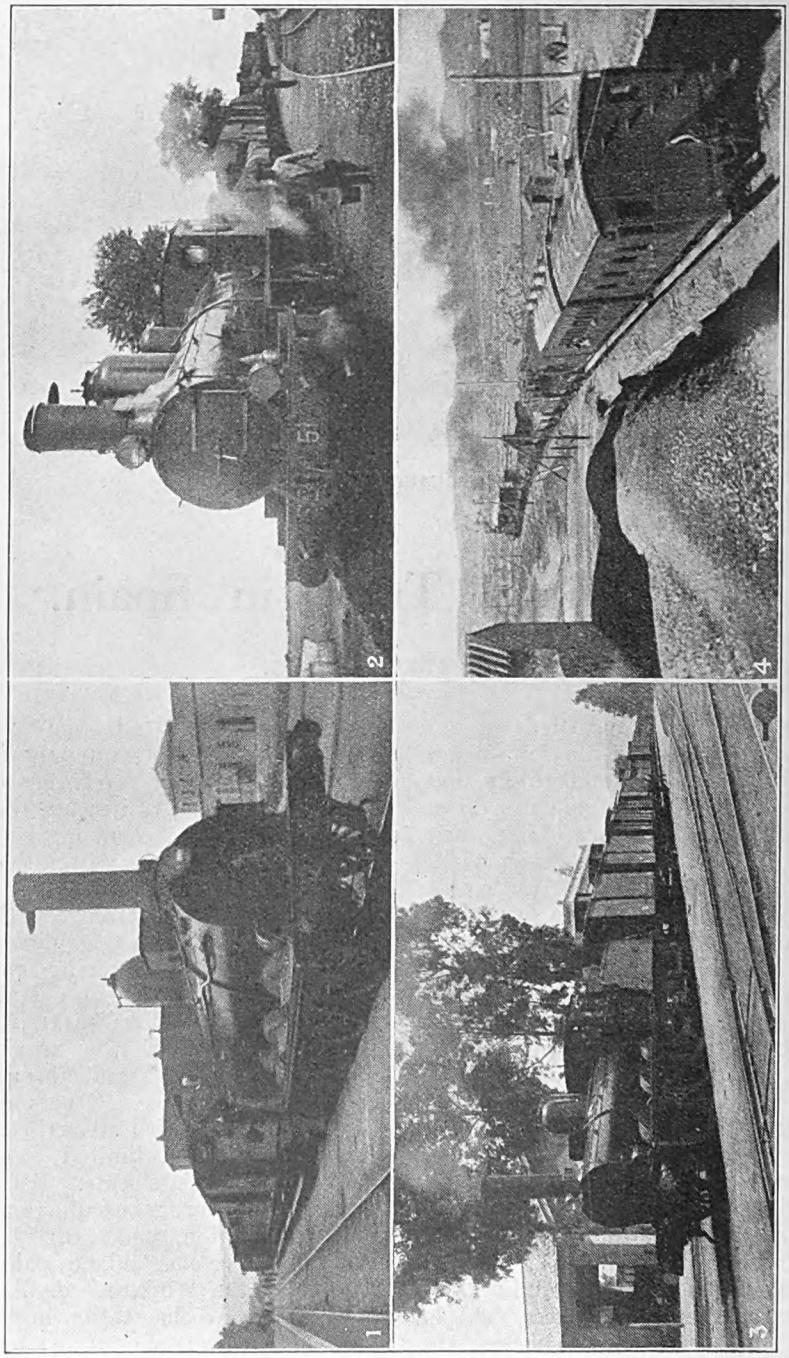

1. ALCANTAVILLA-CARTAGENA TRAIN.
2. BAZA-GUADIX TRAIN.
3. MURCIA-ALICANTE TRAIN.
4. AGUILAS-LORCA TRAIN.

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varying from two or three minutes at the halts to half an hour or more at junctions and transhipping stations. The Seville express does the trip in just half the time. Mixed trains of the better class run fairly punctually and connect with the mail trains at junctions and with branch services along their route. In this way commercial travellers and small traders, who invariably travel on "kilometric" tickets, make their way from one large town to another. A good example of such connections over a long route is the train nicknamed on the Murcia-Cartagena line "el Andaluz." Leaving Seville at 12.10 by mail train 21, the traveller reaches Alcazar junction at 2.35 next morning, in time to catch mixed train 30 at 3.20 for Chincilla, where again he gets another "mixto," No. 36, at 7.50 for Murcia and Cartagena, reaching the latter point at 15, a journey of 911 kilometres, or 566 miles, in 27 hours. This sounds arduous, but it is the best cross-country connection there is without incurring the delay and expense of a night in a hotel.

As a matter of fact, the regular trains such as 30 and 36, above referred to, are good examples of services that have really grown out of the "mixed" stage, and in England they would be called ordinary slow passenger trains. There are, however, good reasons, from the companies' point of view, for retaining the present classification, in the shape of certain legal requirements, which cannot be exacted while a train is supposed to carry merchandise. The slower timing, and use of obsolete engines and coaches, is, of course, another consideration. Generally speaking, all the Spanish railways, as a condition of their concessions, are obliged to run at least one train daily in each direction throughout the system, with postal facilities, at least one non-smokers' compartment, and a "ladies only" compartment. These requirements, as a rule, are fulfilled by the daily mail train or "correo," stopping at every station. First-class through traffic is carried on one or more express trains which are "limited," and often carry no second or third-class accommodation. Then come the "mixtos," which, as described, are really slow passenger trains. And still lower in the scale of speed and comfort come what are the true mixed trains, called "Mercancias con Viajeros," *i.e.*, merchandise trains ***with*** passengers. This class of train is really a goods train with one or more carriages added, and worked on a freight schedule with stops for attaching and detaching at roadside stations.

The working time book of a Spanish railway contains a table of speeds for the four classes of trains, expresses, mail, mixed and goods (military trains run to goods schedule) for every section of the line, and the running time allowed, which must not be exceeded. Thus between Madrid and Aranjuez speeds are 80, 70, 58 and 45 kilometres per hour respectively.* But that is on a main line with double track. On the local lines in the outlying districts the "goods train ***with*** passengers" is usually scheduled to run at about 30 kilometres an hour, with stops of from 5 to 30 minutes' duration, or even more at junctions.

The passengers on these trains are almost exclusively short-distance travellers; commercial travellers and small traders, who are often able to meet their customers, by appointment, on the station platforms and so avoid breaking their journey; country people travelling to fairs or markets, harvest labourers and emigrants.

The mixed train is essentially a day train, in contradistinction to the expresses, which usually run at night. Spain is a country of contrasts and the traveller may occasionally find himself looking out of the window of a luxurious sleeping or restaurant car, during a stop in a roadside station, into the bare boarded compartment of a decrepit fifty-years-old third-class carriage, incongruously coupled to a long and obviously slow goods train. But the "mixto," despite its discomforts, is a very useful institution, and it may be that there are in certain other countries costly passenger trains running to-day on double-track branch lines with impressive but expensive signals, interlocking, &c., which could more economically be worked, and with equal satisfaction to the public, in the same way as are the mixed trains of Spain.

* 8 kilometres = 5 miles roughly.

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THE RAILWAY PORTRAIT GALLERY.

Photo.] [*Elliott & Fry.*

SIR ARTHUR WATSON, C.B.E.,

General Manager,
London Midland and Scottish Railway.

RAILWAY MAGAZINE readers will join with us in congratulating Sir Arthur Watson, the General Manager of the London Midland and Scottish Railway, upon his inclusion in the New Year's Honours List. The new knight had his first railway experience on the former Lancashire and Yorkshire Railway, of which he became General Manager in 1919. When that undertaking was amalgamated with the London and North Western as from January 1, 1922, he became General Manager of the enlarged London and North Western Railway, and has from January 1, 1923, held the chief executive position on the London Midland and Scottish Railway.

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THE RAILWAY PORTRAIT GALLERY.

Photo.] [*Swaine.*

SIR H. A. WALKER, K.C.B.,

General Manager,
Southern Railway.

SIR HERBERT ASHCOMBE WALKER'S appointment as General Manager, Southern Railway, dates from January 1, 1924. Born in London in 1868, his railway career began in 1885 in London and North Western service. From a clerkship he rose step by step until he became London District Superintendent. On January 1, 1912, he succeeded Sir Charles Owens as General Manager of the London and South Western Railway. At the outbreak of war in 1914 he was made Acting Chairman of the Railway Executive Committee, and from 1919 until decontrol continued with the Railway Advisory Committee associated with the Ministry of Transport. Knighted in 1915, he was created a K.C.B. in 1917.

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Locomotive Re-Numbering, London Midland and Scottish Railway.

THE system upon which locomotives now belonging to the London Midland and Scottish Railway are being re-numbered was briefly outlined in the January number. Further particulars are now given, by courtesy of Mr. G. Hughes, C.B.E., Chief Mechanical and Electrical Engineer.

The definite statement that L.M.S. locomotives are not, in future, to be named, will cause regret to that large class of readers of the RAILWAY MAGAZINE who take a lively interest in locomotive matters. The blow is, however, tempered by the pronouncement that "where engines already have names they will be retained."

A re-arrangement of numbers obviously was necessary when thirteen railways, each with a separate locomotive list, became one system. The simplest method would have been to allow the company with the largest number of locomotives to retain its numbers, following on with the railway with the next longest list and so on, until the engines of the 13 lines were in the list. Advantage was, however, taken of the necessity to re-number, to arrange the new list on a systematic basis, following certain defined rules. Consequently, although consecutive numbers are allocated to each *division* of the system, the underlying principle has been to arrange the engine numbers in each division so that locomotives of approximately the same power are grouped together within the divisional series. The careful attention which has been given in this connection affords ample evidence that "rule of thumb" has no place in the L. M. & S. management, even in what might be considered to be the simple matter of locomotive classification and numbering.

In arriving at a decision with regard to the classification, consideration was given to the fact that engines are designed for hauling certain classes of traffic, and the value of an engine for this purpose depends upon the draw-bar pull it produces at speeds at which such traffic is usually run. The draw-bar pull of an engine results from various dimensions, such as cylinder volume, grate area, and resistance of engine and tender as a vehicle, this resistance being dependent on the weight and number of coupled wheels.

Without going too deeply into such matters, classification of the locomotive stock of the L. M. & S. Railway has therefore been based chiefly upon tractive effort, neglecting friction and resistance as a vehicle. It is well known that there is a great divergence between the theoretical nominal tractive effort and the actual results obtained in running. This great difference, although well known to locomotive engineers, was the subject of many tests carried out some years ago on the late L. & Y. Railway. The results of these tests have been diagrammed, and are reproduced on page 133. This diagram shows clearly how the mean effective pressure falls with the increase in the piston speed; with wheels of small diameter excessive piston speed is requisite to run a train at express speed.

The curve of the diagram shows that the nominal tractive effort is by no means a satisfactory method of computing the power of engines, running at speeds other than that at which they are constructed normally to work. The diagram emphasises that the tractive effort of a locomotive with driving wheels of small diameter decreases very rapidly as the speed of the train is augmented; whilst engines with large driving wheels, and consequently a slower piston speed, will retain the benefit of a much higher mean effective pressure. It must not be forgotten that M.E.P. depends also on the size of ports and steam pipes, and chiefly upon the capacity of the boiler to produce sufficient steam.

After due consideration it was determined that the tractive effort (T.E.) of the L. M. & S. Railway freight engines should be based on a speed of 25 m.p.h. and passenger locomotives on 50 m.p.h.

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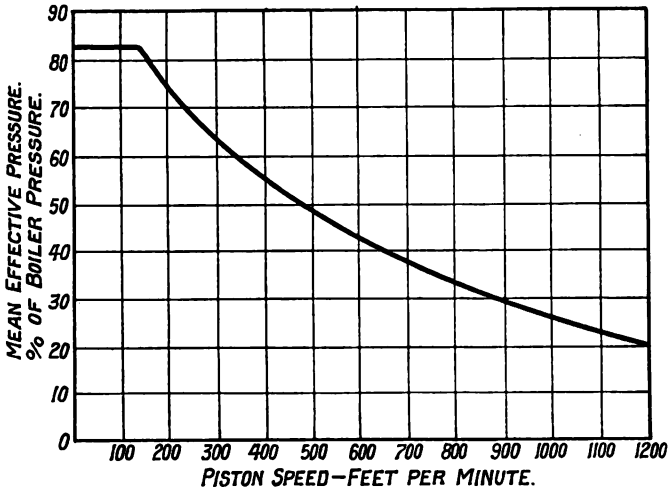

MEAN EFFECTIVE PRESSURE AND SPEED CURVE.
Derived from tests on the late Lancashire & Yorkshire Railway.

The rating has therefore been fixed upon the maximum T.E. the various types of passenger and freight engines develop at the speeds of 50 m.p.h. and 25 m.p.h. respectively. Considering the boiler power, any given T.E. at any given speed represents a definite horse-power. The power of the boiler to provide steam for the T.E. is ascertained as follows:—Taking a maximum combustion rate of 130 lb. of coal per sq. ft. of grate per hour, and an actual evaporation of 6·15 lb. of steam per lb. of coal, this is equivalent to 800 lb. of steam per sq. ft. of grate per hour. Taking the steam consumption per horse-power hour as 25 lb. for saturated and 20 lb. for superheated engines, this is equivalent to 32 and 40 h.p. per sq. ft. of grate.

From results obtained from the above data, the locomotive stock of the L. M. & S. Railway has been divided into five classes for passenger engines and six classes of goods engines, or eleven classes in all, as shown in the table at the foot of this page.

Having arrived at the basis of classification of the many different types and designs of locomotives comprised in the L. M. & S. stock, consideration was given to the method that should be employed in the re-numbering. As a preliminary the numbers in the following series were reserved for the locomotive stocks of the four divisions of the L. M. & S. Railway:—

	Nos. reserved.
Midland Division ..	1 to 4999
Western Division ..	A 5000 ,, 9999
,, ,, ..	B10000 ,, 13999
Northern Division ..	14000 ,, 17999

Particulars are given later in this article of the numbers reserved for the various types of engines in each division. From these tables it will be observed that many numbers in the new list are blank, allowing for additions to the list of each division as the stock is increased. This arrangement appears to imply that in the immediate future it is assumed that the locomotive stock of each division should be kept separate and distinguished by its group of numerals, even although

Class.	Passenger Engines. Tractive effort in tons at 50 m.p.h.*	Class.	Goods Engines. Tractive effort in tons at 25 m.p.h.*
1	1·5 to 2	1	2·85 to 3·6
2	2 ,, 2·5	2	3·6 ,, 4·35
3	2·5 ,, 3	3	4·35 ,, 5·1
4	3 ,, 3·5	4	5·1 ,, 5·85
5	3·5 ,, 4	5	5·85 ,, 6·6
		6	6·6 ,, 7·35

* The tractive effort quoted above is the theoretical force at the rim of the tyre when new, neglecting internal resistances.

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it may be transferred for service on another division.

In conformity with the rules referred to, the least powerful passenger engines in each division have been given the earlier numbers; where two groups of engines are of equal power, the older group takes the lower numbers. The engines have been classified under the various wheel arrangements.

Engines of the same wheel arrangement have been numbered together in order of power classification, although slight differences in the dimensions of sister engines has not led to their separation.

The numbering of the different types of engines has been made in the following order :—

Passenger tender engines.
Passenger tank engines.
Goods tank engines.
Goods tender engines.

The next sub-division follows according to wheel arrangement, both passenger and mixed traffic tender engines being numbered in order, thus :—

0-4-2	4-4-0
2-4-0	4-4-2
4-2-2	4-6-0

Next in the number classification come the goods and mineral tender engines, which are numbered in the following order :—

0-4-0	0-8-0
0-6-0	2-8-0
2-6-0	

The order of passenger tank engines is :

0-4-2	4-4-2
2-4-0	0-6-4
4-4-0	4-6-2
2-4-2	4-6-4
0-4-4	

Finally, the goods tank engines are arranged as follows :—

0-4-0	2-6-2
0-6-0	0-8-0
0-6-2	0-8-2

A few special types are also associated in appropriate sections.

Coming now to the actual numbering, the Midland Division engines, which include the late Midland, North Staffordshire and Stratford-on-Avon and Midland Junction Railways, are classified and numbered as in Table I. (opposite page).

This list, so far as Midland Railway engines are concerned, practically introduces no differences between the old and new notations, from which it is gathered that the Midland Railway plan of classification in relation to numbering has been adopted for the whole of the L. M. & S. Railway, coupled with the fact that Midland engines already carried large numerals on tank or tender sides. Blanks in the original Midland locomotive numbers remain in the new L.M. & S. Railway list. The following is the list of late Midland Railway engines that have had their numbers altered :—

Old No.	New No.
2180	2220
2181	2221
2182	2222
2183	2223
2184	2224
2185	2225
2186	2226
2187	2227
2188	2228
2189	2229
2190	2230
2191	2231
2192	2232
2193	2233
2303	2382
2311	2383
2315	2384
2320	2385
2328	2386
2333	2387
2337	2389
2347	2390
2349	2391
2354	2392
2356	2394
2357	2396
2360	2397
2366	2398
1601	1605
1604	1607

Old numbers 2180—2193 are 0-6-2 goods tank engines, Class 2 G, and the new numbers are necessary to enable seven North Staffordshire Railway 4-4-2 passenger tank engines (Nos. 8, 45, 46, 55, 13, 14 and 39) to follow the Midland 4-4-2 tanks of Class 2 P. Old numbers 2303 and 2311 are now occupied by N.S.R. 0-6-0 tender engines (Class 2) Nos. 7 and 18 respectively; 2315 is unaltered. The 13 changed numbers in the above list between 2320 and 2366 are now borne by N.S.R. 0-6-0 tender engines in the following order :—75A, 110, 116A, 121A, 100, 123, 162, 164, 82, 85, 92, 162, and 164; 85 and 92 are Class 2 G, the others Class 1 G. Old number 1601 is filled by N.S.R. 0-6-0 goods tank. No. 59A, Class 1 G. No. 1604 is blank. It will be noted that the Tilbury section 4-4-2

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TABLE I.—SUMMARY OF LOCOMOTIVE STOCK, MIDLAND DIVISION.

Classification.	New Engine Numbers	Type.	Railway.
Passenger Tender Engines :—			
1	1 to 281	2–4–0	M.R.
1	290		S.M.J.
1	300 ,, 327		M.R.
2	328 ,, 562	4–4–0	M.R.
2	595 ,, 599		N.S.
1	600 ,, 683	4–2–2	M.R.
3	700 ,, 779		
4	900 ,, 999	4–4–0	M.R.
4	1000 ,, 1044		
Tank Engines :—			
1 P	1200 to 1430	0–4–4	M.R.
1 P	1431 ,, 1439		N.S.
1 P	1440 ,, 1451	2–4–0	N.S.
1 P	1454 ,, 1459	2–4–2	N.S.
	1500 ,, 1537	0–4–0	M.R.
1 G*	1550 ,, 1603	0–6–0	N.S.
1 G	1605 ,, 1959		M.R.
2 P	2000 ,, 2039	0–6–4	M.R.
3 P	2040 ,, 2055		N.S.
3 P	2100 ,, 2107	4–6–4	M.R.
2 P	2110 ,, 2119		L.M.S.
1 P	2120 ,, 2145		M.R.
2 P	2146 ,, 2179	4–4–2	M.R.
3 P	2180 ,, 2186		N.S.
1 P	2200 ,, 2209		M.R.
2 G	2220 ,, 2233		M.R.
2 G†	2234 ,, 2269	0–6–2	N.S.
3 G	2270 ,, 2273		L.M.S.
Banking Engine :—			
	2290	0–10–0	M.R.
Goods Tender Engines :—			
1 and 2	2300 to 2311		S.M.J.
1 and 2	2320 ,, 2366	0–6–0	N.S.
1, 2, 3 and 4	2369 ,, 4026		M.R.

* Engine 1599 is Class 3. † Engine 2265 is Class 3.

In the above classification for tank engines "P" denotes that engines have been classified as "Passenger," and "G" that they have been classified as "Goods."

passenger tanks Nos. 2110/2119 and 0–6–2 goods tanks Nos. 2270/2273 are given in the summary table above as having been L. M. & S. stock and not Midland, as they were built for the Tilbury section after the grouping.

The locomotives in the Western Division "A" list (Table II) are all late L. & N.W.R. engines, with the exception of the late Wirral Railway locomotives.

The latter railway's 2–4–2 passenger tanks are now numbered Nos. 6758/6762 in the following order (old Nos.): 4, 11, 16, 17, 6; while the 0–4–4 passenger tanks are now Nos. 6770/6776 in the following order (old Nos.): 2, 5, 8, 9, 7, 10, 3. Wirral Railway 4–4–2 tank No. 1 is now No. 6830, and the two Wirral Railway 0–6–4 passenger tanks Nos. 12

(*Continued on page* 138.)

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TABLE II.—SUMMARY OF LOCOMOTIVE STOCK, WESTERN "A" DIVISION.

Classification.	New Engine Numbers.	Type.	Railway.	Remarks.
Passenger Tender Engines :—				
1	5000 to 5109	2-4-0	L. & N.W.	
2	5110 ,, 5266	4-4-0	L. & N.W.	5110 to 5117 "Jubilee."
3	5270 ,, 5409			5118 ,, 5130 "Alfred the Great."
				5131 ,, 5186 "Renown."
				5187 ,, 5266 "Precursor" Saturated.
				5270 ,, 5319 "Precursor" Superheated.
				5320 ,, 5409 "George V."
3	5450 ,, 5554	4-6-0	L. & N.W.	5450 ,, 5554 "Experiment."
4	5600 ,, 5844			5600 ,, 5844 "Prince of Wales."
5	5900 ,, 6029			5900 ,, 6029 "Claughton."
Passenger Tank Engines :—				
1	6400 ,, 6419	0-4-2	L. & N.W.	
1	6420 ,, 6434	2-4-0	L. & N.W.	
1	6435 ,, 6512	4-4-0	L. & N.W.	
1	6515 ,, 6757	2-4-2	L. & N.W.	
1*	6758 ,, 6762		Wirral.	
1*	6770 ,, 6776	0-4-4	Wirral.	
2	6780 ,, 6829	4-4-2	L. & N.W.	
1	6830		Wirral.	
1	6850 ,, 6851	4-4-4	Wirral.	
1	6860 ,, 6936	0-6-2	L. & N.W.	
2	6948 ,, 6949	0-6-4	Wirral.	
3	6950 ,, 6996	4-6-2	L. & N.W.	
Goods Tank Engines :—				
	7200 ,, 7216	0-4-0	L. & N.W.	
	7217	0-4-2	L. & N.W.	
1	7220 to 7502	0-6-0	L. & N.W.	
1	7503 ,, 7532			
1	7550 ,, 7841	0-6-2	L. & N.W.	
4	7870 ,, 7899	0-8-2	L. & N.W.	
5	7930 ,, 7959	0-8-4	L.M.S.	
Goods Tender Engines :—				
1	8000 ,, 8327	0-6-0	L. & N.W.	8000 to 8087 "Special DX."
2	8330 ,, 8624			8088 ,, 8314 4 ft. 3 in. Coal.
				8330 ,, 8624 5 ft. 0 in. Goods.
4	8700 ,, 8869	4-6-0	L. & N.W.	8700 ,, 8869 19 in. Goods.
2	8900 ,, 8952	0-8-0	L. & N.W.	8900 ,, 8952 "B" class.
3	8953 ,, 9001			8953 ,, 8967 "C" class.
4	9002 ,, 9394			8968 ,, 9001 "C1" class.
5	9395 ,, 9454			9002 ,, 9064 "D" class.
				9065 ,, 9153 "G" class.
				9154 ,, 9394 "G1" class.
				9395 ,, 9454 "G2" class.
2	9600 ,, 9615	2-8-0	L. & N.W.	9600 ,, 9615 "E" and "F" classes.
5	9616 ,, 9645			9616 ,, 9645 R.O.D.

* Engines 6762 and 6776 are Class 2.

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TABLE III.—SUMMARY OF LOCOMOTIVE STOCK, WESTERN "B" DIVISION.

Classification.	New Engine Numbers.	Type.	Railway.	Remarks.
Passenger Tender Engines :—				
1	10000	2-4-0	L. & Y.	Coupé.
	10002		F.R.	
	10005 to 10007		M. & C.	
1	10010 ,, 10013	0-4-2	M. & C.	
1	10100 ,, 10130	4-4-0	L. & Y.	Class 2.
1	10131 ,, 10146		F.R.	
2	10150 ,, 10183		L. & Y.	Class 3.
2	10185 ,, 10188		F.R.	
3	10190 ,, 10195		L. & Y.	Class 4.
2	10300 ,, 10339	4-4-2	L. & Y.	Class 7.
3	10400 ,, 10404	4-6-0		Class 8.
5	10405 ,, 10454		L. & Y.	Class 8 Superheated.
Passenger Tank Engines :—				
	10600 ,, 10617	0-4-0	L. & Y.	Class 1. Rail Motor.
	10618	0-4-4	M. & C.	
	10619 ,, 10620	2-4-2	F.R.	
2	10621 ,, 10899		L. & Y.	Class 5.
3	10900 ,, 10950		L. & Y.	Class 6.
1	11080 ,, 11085	4-4-2	F.R.	
3	11100 ,, 11104	4-6-4	F.R.	
5	11110 ,, 11129		L.M.S.	
	11130 ,, 11169		L.M.S.	
Goods Tank Engines :—				
	11200 ,, 11257	0-4-0	L. & Y.	Class 21.
	11258		F.R.	
	11259 ,, 11260		M. & C.	
	11300 ,, 11302	0-6-0	K.E.	
1	11303 ,, 11532		L. & Y.	Class 23.
2	11533 ,, 11546		L. & Y.	Class 24.
1	11547 ,, 11562		F.R.	
1	11563		M. & C.	
1 and 2	11564 ,, 11568		C. & W.	
1	11600 ,, 11621	0-6-2	L. & Y.	Class 22.
2	11622 ,, 11640		F.R.	
3	11641 ,, 11644		F.R.	
1	11680	2-6-0	K.E.	
3	11700 ,, 11716	2-6-2	L. & Y.	Class 26.
4	11800 ,, 11804	0-8-2	L. & Y.	Class 32.
Goods Tender Engines :—				
	12000 ,, 12014	0-6-0	F.R.	
1	12015 ,, 12064		L. & Y.	Class 25.
1	12065 ,, 12076		F.R.	
1	12077 ,, 12082		M. & C.	
2	12083 ,, 12467		L. & Y.	Class 27.
2	12468 ,, 12483		F.R.	
2	12484 ,, 12493		M. & C.	
3	12494 ,, 12512		F.R.	
3	12513 ,, 12514		M. & C.	
4	12515 ,, 12619		L. & Y.	Class 28.
4	12700 ,, 12770	0-8-0	L. & Y.	Class 30.
5	12771 ,, 12839			Class 30.
6	12840 ,, 12994			Class 31.

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and 13 are now L.M. & S. Nos. 6948/9. The present classification of the late Wirral Railway engines is given in the summary table. The goods tank engines, Class 5, 0–8–4 type, of which there are 30, are given in the summary as L. M. & S. Railway locomotives, because they have been built since the grouping, although in the L. & N. W. Railway locomotive list they had numbers here and there spread over from No. 24 (now 7890) to 2391 (now 7899).

The first L. & N.W. Railway locomotive on the list (No. 5000) was previously No. 2190 *Princess Beatrice*, built in 1875 and rebuilt in 1895. The famous 2–2–2 *Cornwall* No. 3020 is at present not included in the new list, nor are the late L. & N.W. rail motor-cars.

The Western Division "B" list (Table III) covers the engines formerly comprising the locomotive stock of the Lancashire and Yorkshire, Furness, Maryport and Carlisle, Cleator and Workington and Knott End railways.

The first engine in the list is the L. & Y. combined coupé and 2–4–0 engine, previously No. 731. Nos. 10001, 10003, 10004, 10008 and 10009 are blanks. No. 10002 is given to late Furness No. 44A, and Nos. 10005/7 are Maryport and Carlisle Nos. 13, 8 and 10 respectively. The only 0–4–2 tank engines are old M. & C. Railway Nos. 4, 2, 15 and 16. It is not till No. 10100 is reached that this list may be said to commence in earnest, there being only the nine engines above referred to in the first hundred numbers. Nos. 10100/30 are occupied with late L. & Y. engines, the old numbers being spread out from 922 to 1007 and running consecutively from 10103 (978) to 10130 (1007), except that 987 is missing (this L. & Y. engine being a 0–8–0 goods tender locomotive is now No. 12723). The new and old numbers of numerous L. & Y. engines run on consecutively in the new list.

The Furness Railway 4–4–0 passenger tender engines in the list are :—

L. M. & S.	Furness.
10131/4	120/3
10137/40	44/7
10185/8	130/3
10135/6	36/7
10141/6	124/9

The Furness Railway 2–4–2 passenger tanks Nos. 70 and 71 are now 10619/20; the 4–4–2's 38/43 are 11080/5, and the five 4–6–4 tanks 115/119 are 11100/4. Nos. 10950 to 11090 are blank, with the exception of 11080/5; and 11130 to 11190 inclusive also are unappropriated. L.&Y. rail motor No. 3 is 10600 and so consecutively to R.M. 15 (10612). R.M.'s 1, 2, 16, 17 and 18 follow to 10617. At the end of the 0–4–0 goods tanks comes Furness No. 97A, and Maryport and Carlisle R3 and R2 are now 11258/60 respectively. The five Cleator and Workington Railway engines (0–6–0 tanks) were numbered 6 to 10 in that company's list, whilst the four Knott End engines are now 11300 (*Jubilee Queen*), 11301 (*New Century*), 11302 (*Knott End*) and 11680 (*Blackpool*).

The Northern Division locomotive number list (Table IV) of the L. M. & S. Railway includes the engines of the Caledonian, Glasgow and South Western, and Highland Railways.

As the 2–4–0 passenger locomotives come first in the arrangement, as previously explained, the three 2–4–0 engines possessed by the old G. & S.W. Railway at the end of 1922 occupy the earliest numbers in the Northern Division list. The numbers are 14000/2 and the engines were Nos. 727, 720 and 723 respectively of the G. & S.W. Railway. The next appropriated number is 14010, and this is occupied by the old famous Caledonian single (4–2–2), formerly No. 123, but of recent years No. 1123. No other number is filled in the list till 14100, from which number the Caledonian 4–4–0's commence to be listed, No. 1179 occupying the first position, followed in consecutive order to 1188. Seven others in the ten- and eleven-hundreds follow, and with 14116 commences the new numbers of the G. & S. W. Railway engines. By reference to summary table IV, the abbreviated remarks which follow will be more easily comprehended. No. 700 (G. & S. W.) is the first (No. 14116), and with the omission of 705, the numbers run in sequence to 713. 467/8 are inserted, and the numbers again run on from 714 to 717. 14135 is given to 705, the next two numbers being occupied by 718/9. No. 448 is 14138, and G. & S. W. Railway 4–4–0's hold the new numbers up to 14270; the next 15 engines belonged to the Highland Railway. With 14290 commences the Class 2, 4–4–0 passenger tender engines,

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TABLE IV.—SUMMARY OF LOCOMOTIVE STOCK, NORTHERN DIVISION.

Classification.	New Engine Numbers.	Type.	Railway.
Passenger Tender Engines :—			
1	14000 to 14002	2–4–0	G.S.W.
1	14010	4–2–2	Cal.
1	14100 ,, 14115	4–4–0	Cal.
1	14116 ,, 14270	4–4–0	G.S.W.
1	14271 ,, 14285	4–4–0	Highland.
2	14290 ,, 14365	4–4–0	Cal.
2	14366 ,, 14378	4–4–0	G.S.W.
2	14379 ,, 14422	4–4–0	Highland.
3	14430 ,, 14508	4–4–0	Cal.
3	14509 ,, 14521	4–4–0	G.S.W.
3	14522 ,, 14523	4–4–0	Highland.
2	14600 ,, 14626	4–6–0	Cal.
3	14650 ,, 14655		
3	14656 ,, 14674	4–6–0	G.S.W.
3	14675 ,, 14693	4–6–0	Highland.
4	14750 ,, 14761	4–6–0	Cal.
4	14762 ,, 14769	4–6–0	Highland.
5	14800 ,, 14803	4–6–0	Cal.
Passenger Tank Engines :—			
	15000 ,, 15001	0–4–2	Cal.
	15010 ,, 15017	4–4–0	Highland.
1	15020 ,, 15031	4–4–0	Cal.
	15050 ,, 15054	0–4–4	Highland.
1	15100 ,, 15240	0–4–4	Cal.
1	15241 ,, 15254	0–4–4	G.S.W.
2	15300 ,, 15307	0–6–4	Highland.
3	15350 ,, 15361	4–6–2	Cal.
5	15400 ,, 15405	4–6–4	G.S.W.
Goods Tank Engines :—			
	16000 ,, 16039	0–4–0	Cal.
	16040 ,, 16049	0–4–0	G.S.W.
	16050 ,, 16051	0–4–0	G. & P.Jt.
	16080 ,, 16085	0–4–4	G.S.W.
	16100 ,, 16102	0–6–0	Cal.
	16103 ,, 16117	0–6–0	G.S.W.
	16118 ,, 16119	0–6–0	Highland.
1	16150 ,, 16173	0–6–0	Cal.
2	16200 ,, 16376		
2	16377 ,, 16379	0–6–0	G.S.W.
2	16380 ,, 16383	0–6–0	Highland.
3	16400 ,, 16427	0–6–2	G.S.W.
3	16500 ,, 16505	0–8–0	Cal.
Goods Tender Engines :—			
1	17000 ,, 17020	0–4–2	Cal.
1	17021 ,, 17075	0–4–2	G.S.W.
	17100	0–6–0	G.S.W.
1	17101 ,, 17102	0–6–0	Cal.
1	17103 ,, 17212	0–6–0	G.S.W.
2	17230 ,, 17473	0–6–0	Cal.
2	17474 ,, 17524	0–6–0	G.S.W.
3	17550 ,, 17692	0–6–0	Cal.
3	17693 ,, 17704	0–6–0	Highland.
4	17750 ,, 17764	0–6–0	G.S.W.
3	17800 ,, 17804	2–6–0	Cal.
4	17820 ,, 17830	2–6–0	G.S.W.
3	17900 ,, 17915	4–6–0	Cal.
3	17916 ,, 17930	4–6–0	Highland.
5	17950 ,, 17957		
4	17900 ,, 17997	0–8–0	Cal.

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the first being Caledonian No. 1067. At 14366 the G. & S. W. re-appears with No. 337, running in numerical order, except 345, which comes at the end and is 14378. Onward the Highland engines 119/133 follow in order; 14394/5 being 71/72. The next 17 numbers are held by Highland Railway locomotives 1 to 17, the succeeding nine numbers also being occupied by Highland engines. A break of seven unappropriated numbers brings us to 14430; this and the next 78 numbers are occupied by Caledonian Railway engines. At 14509 G. & S. W. Railway Class 3 engines commence and occupy 13 numbers, followed by two Highland engines (73/4). Nos. 14524 to 14599 are blank. The 4–6–0's commence with No. 14600, the Caledonian 50 Class (9 engines) being the first included, followed by Nos. 908 to 917, and 191 to 198 bringing the new number list up to 14626. After many blanks we have 14800/3, which are Caledonian 4–6–0, Nos. 956/9 in Class 5. The 0–4–2 passenger tanks are old Caledonian Nos. 1262/3. The 4–4–0 passenger tanks commence with eight Highland engines, of which six are on the "B" list. 15020 is Caledonian Railway engine No. 1, and the numbers follow consecutively to 12. The old numbers of the 0–6–4 passenger tanks are 39, 66/9, 43, 31, 42 and 43 of the Highland Railway in the order given. The Caledonian 4–6–2 passenger tanks are re-numbered consecutively, the old numbers being 540/5. The Glasgow and Paisley Joint Railway engines (0–4–0 goods tanks) are numbered 16050/1. All the 0–6–2 goods tanks were G. & S.W. Railway engines and numbered in that company's stock list as 1 to 28 inclusive. The Caledonian 0–8–0 goods tanks were 492/497 inclusive. Both these classes run in strict consecutive order in both lists. The 0–4–2 goods tender engines (Caledonian and G. & S.W.) total 76. At 17100 commences Class 1 of the 0–6–0 goods tender engines, followed by Classes 2 and 3 and 15 G. & S.W. Railway engines of the same wheel arrangement in Class 4—Nos. 17750/64 (71 to 85 G. & S.W. Railway). The only Class 5 tender goods engines are Highland Railway Nos. 75/82. The Caledonian 0–8–0 goods are only Class 4; they complete the Northern Division locomotive list (Nos. 17990/7, formerly 600/7).

Photo.] [*F. E. Mackay.*

ABERDEEN AND DUNDEE—EUSTON EXPRESS NEAR LANCASTER.

London & North Western 4–6–0 four-cylinder locomotive No. 180. (New No. 6019.)

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RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, 33, *Tothill Street, Westminster, London, S.W.*1. *No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition* (1924) *of this standard railway reference work is in preparation and will be published in April next.*

Duddeston Viaduct.

This viaduct, connecting the Great Western Railway near Bordesley with the London Midland and Scottish Railway south of New Street station, Birmingham, was a result of the battle of the gauges, though it has never been used. The Birmingham and Oxford Junction Railway was sanctioned in 1846 to extend the broad gauge to Birmingham. By purchasing shares in the market the London and North Western Railway obtained control of the company and determined to construct the line on the narrow gauge, and to terminate it at Birmingham by a junction with the London and North Western Railway just alongside Curzon Street station. Much litigation ensued, and finally the Great Western Railway re-obtained control of the Birmingham and Oxford Junction Railway, but it had to be constructed on the mixed gauge. In 1851 the London and North Western Railway decided to extend to New Street, this extension cutting the connection of the Birmingham and Oxford Junction Railway with Curzon Street. The Great Western Railway opened the Birmingham and Oxford Junction Railway in 1852, and as the London and North Western Railway had lost control of the Birmingham and Oxford Junction Railway, there was no longer any incentive to complete the narrow gauge connection at Birmingham.

[Reply to W. E. BRIGGS.]

Superheated "Precursor" Locomotives.

Further information is supplied by Mr. C. Williams, Crewe, as follows:—There are two classes of superheated "Precursors," viz., those which retain their original 19 by 26 in. cylinders with slide valves, and those which have been rebuilt and assimilated to the "George the Fifth" class. Outwardly, a superheated "Precursor" with slide valves is the same as before superheating. In the case of a rebuild, the difference is, of course, obvious. In addition to being fitted with larger (20½ by 26 in.) cylinders operated by piston valves, and with an extended smokebox, a new bogie with 3 ft. 3 in. wheels is substituted for the original with 3 ft. 9 in. wheels. The "Precursors" thus converted are in every way similar to the "George the Fifths," the difference in their respective splashers being only a detail. With regard to the "George the Fifth" class proper, all were superheated when originally built with the exception of the 10 which were converted from non-superheater, and which comprised the original "Queen Mary" class. These were so built, however, that no alteration

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was needed when the conversion took place.

[Further reply to "CANDIDATE."]

Southern Railway (S.E. and C. Section) Locomotives.

We cannot answer queries as to the whereabouts of individual locomotives. Probably the old engines you mention have been withdrawn from service, unless they are being reconstructed at Ashford or have been transferred elsewhere. 0-6-0 goods engines frequently work passenger trains on suitable duties, so that there is nothing remarkable in the fact that an old engine of this class kept time when working a passenger train from Redhill to London. If the engine you mention particularly was usually engaged on shunting duty at Redhill, it had probably taken the place of another locomotive. L. M. & S. and G.W. locomotives sometimes work through on to the Southern Railway with goods trains *via* Addison Road and Clapham Junction. Hence the appearance of locomotives of these lines at Selhurst, as noted by you.

[Reply to H. S. BRADLEY.]

Staggered Rail-Joints.

It is nothing new to "stagger" the rail-joints in this country, *i.e.*, to arrange them so that the joint in one rail of a single line of rails is opposite the centre of the other rail. The whole of the Great Southern and Western Railway of Ireland is so laid, and considerable lengths of the Great Eastern section of the L. & N.E.R., as well as experimental lengths on other lines. There are various advantages to be derived from the practice, which, as you say, is very common in the U.S.A., but the chief objection is that the alternation of oscillations from one side to the other of the vehicles, as they pass over the joints, tends to set up a lurching motion, which is undesirable at high speeds. Exceptionally careful packing of sleepers at rail-joints is essential with staggered-joint track.

[Reply to "SAPPER."]

L. & N.E. Lines in London Area.

Relief empty carriage lines are being constructed between Bow Junction and Stratford to relieve the running lines of empty carriage trains. It is probable, however, that the new works between Liverpool Street and Fenchurch Street and Stratford, proposed by the Company's Parliamentary Bill, relate more particularly to improvements designed to facilitate traffic working, and with a view to electric working, if and when that is introduced. We have no information as to proposed alterations at Ipswich. Your remarks as to a Great Central 4-4-2 working the Liverpool-Harwich Continental express having been seen at Ipswich, and a Great Northern "Atlantic" at Brentwood, are noted.

[Reply to "F. T. M."]

Should Locomotives Push or Pull?

We cannot call to mind any tests as to whether a locomotive can deal with a heavy load better when pushing than pulling. Much depends, of course, on circumstances, but, in any case, it would not be permitted to place the locomotive behind, while provision of connections to control gear at the leading end, as in the case of motor trains, would be impracticable, unless the vehicles were in permanently coupled sets. Even then, the distance between the engine and the leading compartment would be far too great. Motor trains work with as many as three vehicles in front of the engine, but we do not know whether more could be conveniently employed, even if allowed.

[Reply to G. W. SPINK.]

Largest Locomotives.

As we have many times explained, the term "largest" is too vague for general use in connection with locomotive engines, especially those with tenders, the weight of which may render the smaller engine the heavier when weights of engine and tender are combined. Several classes of engines can be classed together as the "largest" before the introduction of the Great Northern and North Eastern "Pacifics," if the Great Western "Great Bear" is also omitted. Among these may be mentioned the Caledonian three-cylinder, Lancashire and Yorkshire four-cylinder, London and North Western "Claughton," and Great Western "Star" 4-6-0 classes.

[Reply to "GREAT BEAR."]

Southern Railway Locomotives and Rolling-Stock.

Your remarks as to the appearance of Southern Railway locomotives and rolling

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stock in green livery are noted. We can only repeat our statement that no official announcement has yet been made as to the standards which will be adopted. No. 685 is, we believe, one of the Wainwright 0-6-0 tender engines converted to saddle tank some years ago. Questions as to individual locomotives, classes and sheds where stationed, cannot be answered in this column unless they relate to matters of general interest.

[Reply to "THANET, LIMITED," "A SOUTHERNER," and others.]

London and North Eastern Railway Locomotives.

Mr. P. Sammons refers to the fact that several late Great Central locomotives having "B" numbers, to indicate that they are duplicates, are stationed at Langwith Junction and Sheffield. Among these are 0-6-0 tender engines Nos. 45 B and 6 B, and Lancashire, Derbyshire and East Coast 0-4-4 tank engines Nos. 1149 B and 1150 B. Mr. R. Taylor mentions that he has seen one of these locomotives painted in the new style, although the engine belonged to the Great Central Railway, a small B being painted under the number plate.

[Further reply to F. E. M.]

Bogie Shields, L.M.S. (Midland) Locomotives.

Shields carried in front of the leading bogie wheels of Midland 4-4-0 express engines are thin steel plates, designed to protect the bearings and motion of the engine when it is the second, or "train," engine of a piloted train, from the dust and grit thrown up by the leading engine, and especially from the rush of water caused by the scoop of the leading engine when water is being taken from track-troughs. The prevalence of piloting on the Midland Division of the L.M.S. explains the need of this special provision.

[Reply to K. H. S. MASSEY.]

Bordon-Longmoor Branch.

The line connecting the Southern Railway station at Bordon with the camp at Longmoor is a private line, providing connection with the camp at the latter place. We have no knowledge as to the extent to which it is now used, but presumably it is operated as required to meet camp requirements. The new engines which you mention will be described as soon as they are placed in traffic. We understand, however, that they are not likely to make their appearance for a few months, if not longer.

[Reply to R. HOGAN.]

Southern Railway Locomotives.

4-6-0 locomotives of the "482" and "330" classes are principally employed on goods traffic. During the first few years of their life the "482" class were often employed on express train working, and a number of runs behind them were recorded in the RAILWAY MAGAZINE. We cannot call to mind any of recent date. Practically all the 4-6-0's with 6 ft. wheels are now on goods traffic. The "Drummond" four-cylinder 4-6-0's with 6 ft. 7 in. coupled wheels are, however, frequently to be seen on main line work.

[Reply to "HANTS."]

L. and N.E. (G.E. Section) 4-6-0 Locomotives.

If stationed at Cambridge or other depot from which engines do not work through Witham Junction, certain engines of a particular class would not, of course, come under your notice. Possibly, that explains why you have not seen the engines mentioned. We have noted one, if not both, of the engines specified at Liverpool Street comparatively recently. Your remarks as to repainted locomotives are noted.

[Reply to "WITHAM EAST."]

West Coast 12-Wheeled Corridor Stock.

It is only on the 1.30 p.m. down Scottish express out of Euston that the special set of 12-wheeled passenger cars is employed, there being generally five 12-wheeled cars for Edinburgh and Glasgow, with two 12-wheeled dining cars, and additional 8-wheelers for Aberdeen, Whitehaven and Windermere. The only 12-wheeled stock normally run on the 10 a.m. is a couple of dining cars.

[Reply to "SHAP SUMMIT."]

West Coast Penzance-Aberdeen Service.

The working of this service was fully explained recently. For your information, however, we would repeat that between Crewe and Stirling these vehicles were

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conveyed attached to the Limited Mail express, and, therefore, did not appear in the public time-tables between those points. This explains the arrival at Stirling at 5.17 a.m.

[Reply to " JANITOR."]

South Western Gradient Profiles.

Main line from Waterloo to Weymouth appeared in July, 1904, and from Basingstoke to Plymouth and Ilfracombe in August and September, 1904. Mr. Cecil J. Allen repeated the Waterloo-Basingstoke profile in November, 1914, and the Salisbury-Exeter profile in November, 1921 ; he also gives a considerable amount of detail concerning the gradients over these sections in his " British Locomotive Practice and Performance " in the present issue.

[Reply to K. H. S. MASSEY.]

High Peak Line, L.M.S.R.

Mr. C. Williams, Crewe, supplements information given previously by directing attention to the fact that the Cromford and High Peak Railway was taken over by the late London and North Western Company in 1871. The then locomotive stock of the Cromford and High Peak Railway consisted of five engines ; these were numbered 2039—2043 in the London and North Western list.

[Further reply to R. HALKETT.]

Permanent Way Caution.

The illuminated letters " C " and " T " you have noted indicate the commencement and termination, respectively, of a section of line where reduced speed is entailed owing to relaying or other operations. The " black distant signal," as you describe it, has a corresponding indication, representing a method in force before the illuminated letters became general.

[Reply to C. M.]

Track Circuit Indicators.

White diamonds indicate, as we have on several occasions explained, that the section of track concerned is protected by track circuit or in other ways, so that it is not necessary for the driver of a train kept waiting at the signal to send his fireman to the signal box, under Rule 55, as a reminder to the signalman of a waiting train.

[Reply to " NORTHAMPTONIAN."]

Locomotive Type Names.

As the RAILWAY MAGAZINE has several times explained, the terms " Atlantic," " Pacific," &c., were adopted by American railways as code names for engines of the types in question before the numeral system became general. " Baltic " is, however, a British term adopted as the Americans had no such engines.

[Reply to T. W. DRON.]

The " Southern Belle."

The recent appearance of the up " Southern Belle " in the London area hauled by a 0-4-2 engine was doubtless a case of a locomotive failure in the immediate vicinity of town, the small engine noted being the only locomotive readily available as a substitute for the completion of the journey.

[Reply to ARNOLD H. BECK.]

Tractive Efforts of L.N.E. (G.C.) Engines.

We have given the tractive efforts of both the types you name in previous issues, which please consult, or you can find the leading dimensions of all the chief L. & N.E. tender types, including tractive effort, in the November and December *L. & N.E. (Great Eastern) Magazine.*

[Reply to " G.C. ENTHUSIAST."]

Southern Railway Locomotives.

As explained in the January RAILWAY MAGAZINE, no official intimation has yet been made as to the painting and lettering of Southern Railway locomotives, notwithstanding the appearance on various sections of engines painted green and lettered " Southern Railway."

[Reply to E. P. FISHER, " F. T. M.," and others.]

Pullman Cars, L.N.E.R.

It is possible that the Pullman car you noticed attached to an ordinary train was run for special purposes, but the probability is that it had received attention at Doncaster and was being returned to London, especially in view of the fact that it was attached at the rear.

[Reply to C. A. JOHNS.]

Locomotives on Irish Railways.

A Belfast reader expresses his willingness to supply information in regard to locomotives on Irish railways, par-

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ticularly those of the Northern sections, to interested readers who may care to address J.F. K., c/o RAILWAY MAGAZINE, enclosing a stamped addressed envelope.

[Further reply to W. R.]

Edge Hill Light Railway.

This line, which connects at Burton Dassett with the S.M.J. section of the Midland Division of the London Midland and Scottish Railway, is owned by the Edge Hill Light Railway Company. Construction has not yet been completed, but a section is in limited use.

[Reply to A. MIALL.]

Euston-Manchester *via* Stoke.

All the London-Manchester expresses which travel *via* Stoke-on-Trent, except the two up trains calling at Stafford, join or leave the old North Western main line at Colwich, and take the direct line between Colwich and Stone Junction, *via* Aston-by-Stone.

[Reply to CECIL L. H. WAY.]

Rebuilt Locomotives.

On the late Midland Railway it was usual to regard locomotives built in replacement of old ones and not on capital charge as rebuilds, though they might actually be entirely new engines. Hence the description of the new "Tilbury" tank engines as rebuilds.

[Reply to "C. J. TILBURY."]

Water Supply for Railway Carriages.

Apparently you refer to the means for refilling water tanks of lavatory carriages at certain terminal stations. The supply pipe is, however, connected to a standpipe or travelling tank, and not to the carriage itself near the footboard.

[Reply to T. D. C.]

Non-stop Running, Manchester-Bangor.

This run of the 11.15 a.m. from Manchester (Exchange) to Holyhead and Pwllheli on Saturdays only throughout the summer was actually non-stop for the distance of 99¾ miles, as advertised.

[Reply to CECIL L. H. WAY.]

Maximum "Claughton" Speeds.

Speeds in excess of 80 m.p.h. have been reached by these engines, and duly recorded in Mr. Cecil J. Allen's monthly articles, but we have no record of any more exceptional maxima than these.

[Reply to "SHAP SUMMIT."]

L.M.S. (Midland) 0-10-0 Engine No. 2290.

We have no information as to the horse-power of this engine, neither is it customary to employ horse-power as a unit of measurement of the tractive power of locomotives.

[Reply to "NORTHAMPTONIAN."]

Compound Locomotives, Great Western Railway.

Mr. A. W. Ashton mentions that all three engines are now at Oxford, usually working trains between Oxford and Wolverhampton, Worcester, Basingstoke, and occasionally to London.

[Further reply to J. JENNINGS.]

Old L. and N.W. Engines.

The Rev. H. M. Marshall confirms that No. 790, *Hardwicke*, is still in service. He has observed the engine on several occasions at Camden sheds.

[Further reply to "L.M.S."]

North Lindsey Light Railway.

This line, which for some years was worked by the Great Central Railway, is now incorporated in the London and North Eastern group.

[Reply to "WAVERLEY."]

4-6-2 Locomotives, L. and N.E.R.

In addition to the twelve locomotives of the present order, twenty further engines of the Great Northern 4-6-2 class are to be constructed at Doncaster.

[Reply to A. C.]

"Brighton" Locomotive.

Presumably you refer to the "top feed" connection provided on top of the boiler in the case of the 4-6-4 tanks and other modern engines.

[Reply to T. D. C.]

Railway Gauges.

Guernsey Railway, 4 ft. 8½ in.; Isle of Thanet Light Railway, 3 ft. 6 in. We are not aware that the latter, practically a tramway, was ever worked by steam power.

[Reply to "CALDICOT."]

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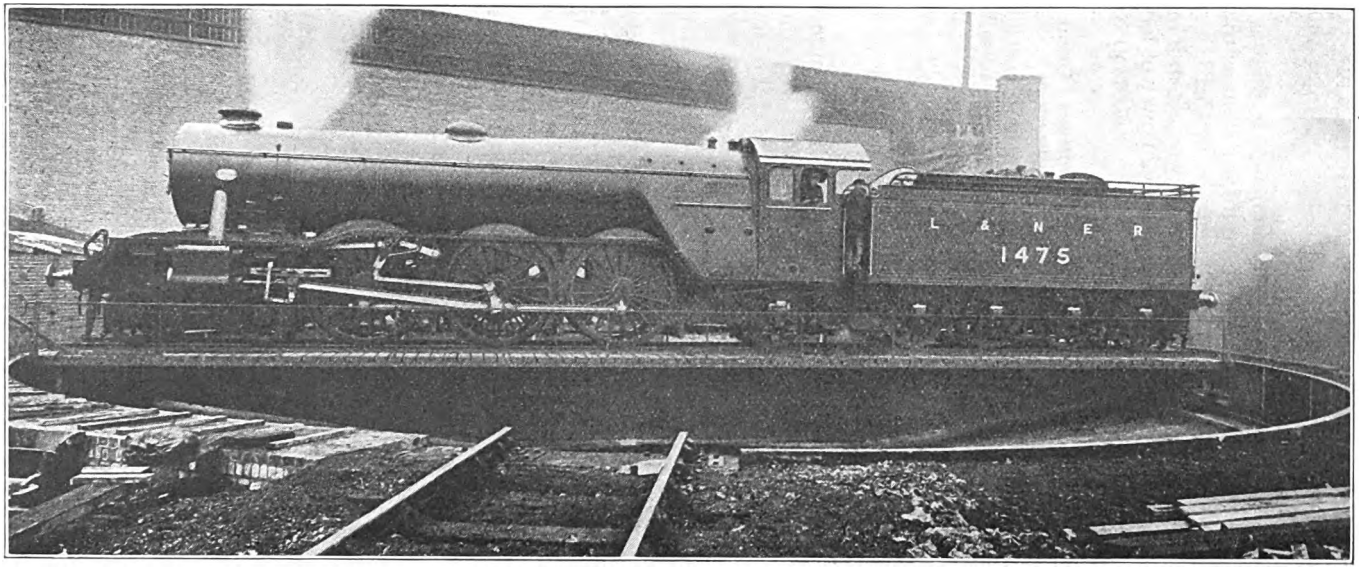
NEW 70-FT. TURNTABLE AT KING'S CROSS, LONDON & NORTH EASTERN RAILWAY.



IN connection with alterations and improvements in progress at King's Cross station, London and North Eastern Railway, a 70-ft. turntable has recently been brought into use, to enable "Pacific" express passenger engines to be turned at King's Cross, thus avoiding the necessity for light mileage to and from Hornsey for the purpose.

By the courtesy of Mr. W. G. P. Maclure, Running Superintendent, Southern Area, a view is reproduced showing No. 1475 on the turntable, this being the first occasion on which one of these engines has been turned at King's Cross.

The turntable was constructed by Ransomes & Rapier Ltd., of Waterside Works, Ipswich, and is of the central-balanced type, and it is fitted with all the latest improvements, being equipped with a cross timber platform. It is 70 ft. diam. and designed for a working load of 165 tons.

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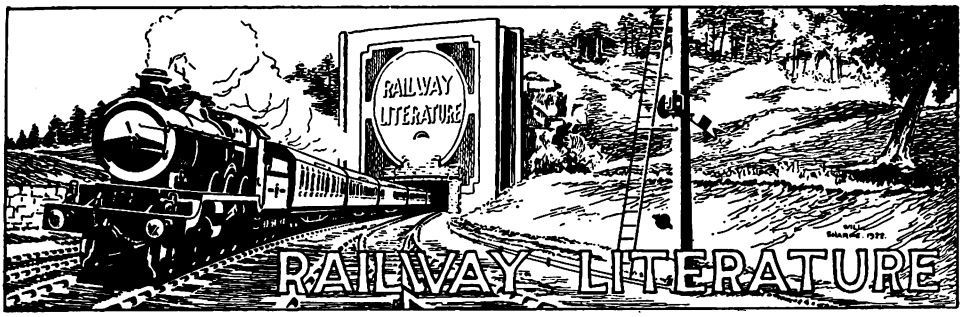

RAILWAY OPERATING STATISTICS. By the late C. P. Mossop. Revised by F. H. Graveson. [London: *The Railway Gazette*, 33, Tothill Street, Westminster, S.W.1. Cloth, 7½ in. × 5 in. 150 pp. Price 4s. net.]

This is the second edition of the book originally written by the late Mr. C. P. Mossop, formerly head of the Statistics department, North Eastern Railway, and published in 1911. It has been revised by Mr. F. H. Graveson, Assistant to the Divisional General Manager, N.E. Area, L.N.E.R. Mr. Mossop's aim was to set out on broad lines the objects to be served by the use of statistics relating to the operation of a railway, and the compilation of the book was undertaken primarily for the use of the students attending North Eastern Railway classes. Since the first edition was published, changes have taken place in railway administration and organisation. The Railway Returns Act (1911) rendered it incumbent upon railway companies to embody certain statistical information in their annual accounts. Subsequently the Railways Act of 1921 compelled each company to render to the Ministry of Transport regular returns appertaining to all branches of railway working. In order to meet the requirements of the Ministry of Transport modifications have been necessary in many of the statistical returns compiled by the North Eastern Area, and in revising the book the tables and diagrams have been brought up to date and the form and returns amended as far as it is possible to do so without trespassing on the opinions expressed by the original author.

The contents of the book include: General objects of operating statistics; figures necessary for securing operating efficiency; practical utility of ton-miles, wagon-miles and commodity statistics; wagon loads; freight-train loads; freight-train working costs; passenger operating statistics; rolling-stock user; docks; cartage; rules for compiling engine miles, engine hours, costs, &c.; Ministry of Transport statistics.

PULVERISED AND COLLOIDAL FUEL. By J. T. Dunn, D.Sc. (Dunelm), F.I.C. [Ernest Benn Ltd., 8, Bouverie Street, London, E.C.4. Price 25s. net.] This volume of 196 large pages, with 54 illustrations in line or half-tone, some on folding plates, provides a comprehensive exposition of principles and descriptions of typical plant for preparing or utilising powdered coal. The author has collected data from many sources, so that his consideration of his subject under various headings is relatively complete, both technically and practically. In the earlier sections combustion is considered from the chemical and calorific points of view, particular attention being given to consideration of coal consumption in lump and powder. A short historical review is included, together with a general description of the principal methods of utilising powdered fuel. Subsequent chapters deal with the preparation and transport of powdered fuel, the latter heading applying more particularly to means of feeding from storage chamber to furnace. Forms of feeders and burners and associated devices then receive attention, followed by a study of fuels suitable for use in powdered form. Ash disposal, general conditions of combustion, applications of powdered fuel, costs, advantages and disadvantages and possibilities provide subject-matter for further sections, while the concluding chapter is concerned with colloidal fuel in which oil is used in combination with powdered fuel. Among the applications attention is given to locomotives fitted for burning powdered or colloidal fuel, involving reference to tests carried out by Mr. J. G. Robinson, late Chief Mechanical Engineer of the Great Central Railway; also in American practice. This volume will, no doubt, be appreciated by our technical readers, while the attention given to economic aspects will be of value to engineers responsible for steam-raising plant, electric power stations, &c., and to some extent to locomotive engineers.

THE UTILISATION OF LOW-GRADE AND WASTE FUEL. By W. Francis Goodrich, M.B.E. [Ernest Benn Ltd., 8, Bouverie Street, London, E.C.4. Price 42s. net.]

This volume, which follows several others recently reviewed concerned with the various aspects of the fuel problem, deals particularly

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with those qualities which, until recently, were regarded as of little value, though now their utilisation is receiving close attention. The subject is of particular importance in view of the fact that, although the medium and high-grade fuels are found principally in relatively limited areas, there are extensive districts, particularly in parts of Europe, Australia, &c., where large supplies of peat, lignite, brown coal and other inferior fuels are available. The development of their use as an alternative to the importation of expensive fuels of better qualities, therefore, offers wide possibilities, while even in countries where good fuels are available there is considerable scope for the use of low-grade fuels where the question of cost may be a controlling factor. In his preface, the author quotes an American writer, who termed lignite "the fuel of the future," and, in so far as this view is justified, this volume is worthy of the most careful study. In the course of 368 large pages and with the aid of 44 tables (a most valuable feature) and 212 illustrations, the author has covered the ground very thoroughly. Earlier chapters discuss the utilisation of waste fuels, colliery waste and coal conservation, lignite and brown coal, peat, coke breeze, the fuel value of towns' refuse, briquettes and briquetting, fuel recovery, utilisation of wood and miscellaneous waste, and the gasification of low-grade and waste coal. Remaining chapters deal with steam boiler design and equipment, furnaces and firing, boiler-house plant, boiler-house control, and the training of firemen where low-grade and waste fuels are utilised. A comprehensive bibliography and a very complete index add to the value of a work which can be cordially recommended.

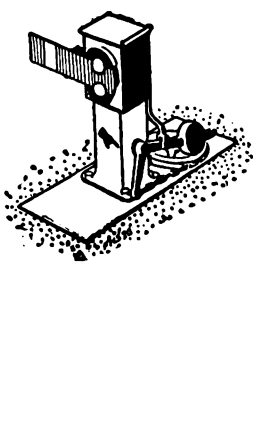
THE SHIP AND HER WORK. By Sir Westcott Abell, K.B.E. [Gee & Co. (Publishers), Ltd., 6, Kirby Street, E.C.1. Price 7s. 9d. net, post free.]

This little volume contains an abbreviated outline of lectures delivered by the author at the London School of Economics to students specialising in shipping for the B.Com. Degree of the London University. The title well describes the subject-matter, which in the six chapters is elaborated under the sections, Sea Work, Sea Risks, Sea Structures, Sea Discipline (Registry, Classification and Load Lines) and Sea Engines. There are four tables and eleven diagrams, which should assist considerably in elucidation of the text, although diagram 7 (the risk to passengers) fails somewhat. The top line reference is shown as 300 per cent., which it cannot be. By inspecting closely the other percentage figures of the diagram we found a microscopic decimal point in front of them, from which we gather that 300 per cent. is meant to be ·300 per cent., or, as it should be shown for clearness, 0·3 per cent.

Brevity of definition surely has been carried to the extreme limit when, in the chapter on "Sea Structures," we read, "The smaller the weight of the ship, the greater is the amount of cargo that can be carried"—apparently a qualifying reference to the size is missing. Despite such slips, the volume should be of distinct assistance to landsmen who need, or desire, to have some knowledge of the ship and her work.

L. & N.E.R. THREE-CYLINDER 4-6-2 LOCOMOTIVE. [Locomotive Publishing Company Ltd. Price 1s. 6d. net.]

This, the latest addition to the series of locomotive charts issued by these publishers, will no doubt be appreciated by the large number of readers who are keenly interested in Mr. Gresley's well-known "Pacific" locomotives. The chart is 31½ in. by 17½ in., and shows a pictorial section of the engine without tender, on a scale sufficiently large for clearness of reference, in conjunction with the table below. It is arranged to fold within a cover to a convenient size.



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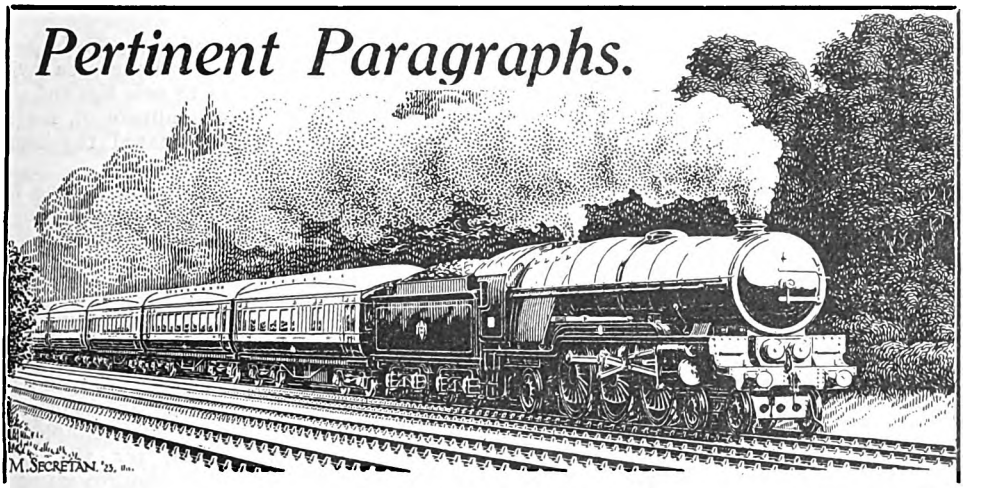
Pertinent Paragraphs.



Big L.M.S. Railway Contracts.

LARGE contracts have been, or are being, placed by the various railway companies for rolling-stock, locomotives, engineering material, &c. In the case of the London Midland and Scottish Railway these contracts include 127,000 tons of steel rails, 150 locomotive boilers and 5,000 wagons, and together represent an amount exceeding £2,000,000. It will be recalled that, in October last, following the Prime Minister's request to the railway companies to expedite the completion of their programmes, the London Midland & Scottish Railway Company announced their intention of spending the sum of £14,000,000. The contracts now let are for substantial sums, and firms in all parts of the country are concerned. All the wagons ordered are of 12-tons capacity, and as a similar large order has also been given by the London & North Eastern Railway for 12-ton wagons, it would appear that the 10-ton wagon is doomed to disappear, at any rate for general purposes. The 12-ton goods wagons are to have steel frames.

New L. & N.E.R. Rolling-Stock.

THE London & North Eastern programme will include the construction of over 700 vehicles, involving an expenditure of close upon £1,700,000. The outstanding feature is the provision of four complete dining-car trains for the up and down day trains between London (King's Cross) and Edinburgh (Waverley). The food on these trains will be cooked entirely by electricity, in view of the successful results which have followed the electric kitchen installations in use on London-Leeds trains. The dining portion of each of the new trains will be composed of three vehicles carried on four four-wheeled bogies, thereby forming a triple "articulated" set, consisting of an open first-class car, an open third-class car, and a kitchen car in the centre. All new stock will be fitted with Pullman vestibules, while stock for the important main line services will be fitted with automatic couplings. New suburban stock will be built of a type which can readily be converted to electrified working. Two entirely new trains will be constructed for the London (Liverpool Street)-Harwich boat trains. All new passenger coaches for both suburban and general traffic will be heated by steam and lighted by electricity; 414 of these vehicles are to be built in the company's own workshops, and 290 vehicles for the London suburban services are to be put out to contract. Over 500 vehicles in existing suburban service are to be broken up.

New Locomotives for the L. & N.E.R.

THE amended locomotive programme will cost £1,270,000, and provides for the construction of 273 locomotives as follows:—

104 engines to be built in the company's workshops.

44 engines to be built by contract—

- 20 4-6-2 express passenger engines (Pacific type), to be built by the North British Locomotive Company, Glasgow.
- 12 4-4-0 express passenger engines, to be built by Kitson & Co. Ltd., Leeds.
- 12 4-4-0 express passenger engines, to be built by Sir W. G. Armstrong, Whitworth & Co. Ltd., Newcastle.

125 large mineral engines of the Great Central type have been purchased from the Government.

The wagon-building programme has been increased, and over 12,000 vehicles are to be put in hand at a total cost of just under £2,400,000. Of these, 11,750 are to be built in the company's workshops, and 80 refrigerator vans and 300 goods brake vans will be put out to contract. It will thus be seen

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that the company's locomotive, carriage-building and wagon-building programmes for 1924 involve an expenditure approaching £5,500,000. From the fact that certain contracts are being placed with outside firms in order to ensure early delivery, it will be appreciated that the company's own workshops will be kept going at full capacity.

Among other works to be put in hand are the construction of an entirely new passenger station at Berwick. At Woodhouse (between Sheffield and Beighton) it is proposed to extend the up and down goods lines and re-arrange the junction. These alterations will enable trains to proceed from and to the direction of London without crossing the track of main line trains. A new halt is being provided on the north side of the River Dee at Hawarden Bridge (Flintshire) to give additional facilities for the residents of the Sealand Garden City and for the workmen employed at Summers & Sons' iron-works. About £34,000 will be spent to provide increased accommodation in the marshalling yard at Dewsnap, Guide Bridge, in order to facilitate the working of up goods trains and trains of empty coal wagons destined for about 130 collieries in South Yorkshire, Derbyshire, and Nottinghamshire. Train control is to be installed between Manchester and Nottingham, one of the most congested portions of the Great Central section of the London & North Eastern Railway. At Grimsby, the No. 3 coal drop, Alexandra Dock, is to be reconstructed. This has been in dis-use for some years. Additional facilities will thus be provided for the shipment of coal at Grimsby and enable the requirements of the coal exporters who ship coal through that port to be more satisfactorily met.

New Great Western Works.

FURTHER details respecting the £10,000,000 programme of the Great Western Railway are also available. Considerable progress has been made towards accelerating the overtaking of arrears of relaying the permanent way, &c. Orders have been placed for 32,000 tons of steel rails, 20,000 tons of rail chairs, 15,000 tons of wheel tyres, and 46,000 wheel centres. In addition, it is proposed that a considerable portion of the orders for coaches and wagons, which in the ordinary course would have been carried out at Swindon, shall be placed with private firms, and orders will be given at an early date for from 300 to 500 20-ton mineral wagons. Orders have been placed for the repair of a number of locomotives of amalgamated companies, which will be undertaken by outside firms, with whom orders have also been placed for 50 locomotive boilers. Work has been commenced on the reconstruction and modernisation of coal-tipping appliances at the South Wales docks, and tenders have been invited for the construction of 18 new tips and other work involving an expenditure of, roughly, £475,000, the total estimated requirement being nearly £2,000,000.

Other large contracts which have been definitely placed include the following:—New tunnel at Colwall, 4,800 ft. long, under the Malvern Hills; completion of railway between Felin Fran and Pontardawe (Glam.); doubling of line between Welshpool and Forden; new accommodation for milk traffic at Paddington; new locomotive depot at Llanelly; new engine shop at Cardiff; road bridge under the railway at Ashley Hill, Bristol, for the new road from Stapleton to Ashley Hill (undertaken for the Bristol Corporation); extensive improvements at the Walsall Street goods depot, Wolverhampton; electrification of a large number of cranes in the Birmingham district; Cardiff Docks—new power house and improved pumping arrangements; Port Talbot—new wharf. Part contracts have been let for the reconstruction of Newport (High Street) station, on which £497,000 is to be expended, and for the rebuilding of Swansea (High Street) station, which will cost £264,000.

Stations to be Reconstructed.

OTHER large authorised works which have been or are about to be commenced are:—Reconstruction of Bristol (Temple Meads) goods station, £556,450; reconstruction of Newton Abbot station, £247,100; new line from Wolverhampton to Kingswinford, £173,000; new locomotive depot at Stourbridge, £119,230; additional sidings for coal shipment at Newport (Mon.), Rogerstone, Cardiff and Barry, £500,000; new locomotive repair depot at Caerphilly, £174,000; station improvements at Oswestry, Aberystwyth and Barmouth, £180,000. A number of smaller schemes which have been or are about to be started amount to an aggregate of £427,674.

Orders are about to be placed for two steamships for the Weymouth and Channel Islands service, and for new bridges, improved grain and warehouse equipment, renewal of passenger landing stages at Cardiff Docks, new cranes at Swansea Docks, and repair work at the West Wharf, Plymouth. In addition, the company is advancing on easy terms large sums of money to enable its staff to build houses by means of public utility societies formed by the men. Parliamentary powers are being sought by the Great Western Railway for new railways from Pwllheli to Nevin, Pwllheli to Abersoch and Stourbridge Junction to Kinver, and for the acquisition of land in South Wales to facilitate the shipment of coal.

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Railway Wages Board Decision.

THE National Wages Board has given its decision on the claims recently submitted to it for certain modifications in the conditions of service of railway employees. The award recommends some changes in the existing practice as to the rate of pay for Sunday to Monday turns of duty and as to minimum payment for Sunday duty. With regard to enginemen, the mileage principle is maintained, but the basis is to be 150 miles per day, instead of 120, and mileage in excess of that figure is to be paid for on the basis of 15 miles an hour, such system to be applicable to drivers, motormen and firemen. The Board does not adopt the companies' classification scheme, but considers that as regards the pay of drivers, motormen, firemen and assistant motormen, other than those on mileage, there is some case for discrimination in the case of drivers on shunting engines (not performing train-miles or working with a brake van), shed yard engines and preparation or disposal of engines, with the proviso that no man engaged on the above work at present receiving 15s. a day shall be reduced. Variation of time allowances for disposal of engines is recommended in accordance with the companies' proposals. The present practice with regard to payment for night duty of conciliation grades, and of double-time on Sundays to platelayers and certain other permanent way men, is retained. In the Board's opinion the time is not ripe to interfere with the operation of the sliding scale. The findings upon certain of the claims are those of a majority, but whilst they support some of the companies' claims to a limited extent, they virtually reject the counter-proposals of the Associated Society of Locomotive Engineers and Firemen and of the Railway Clerks' Association.

L.M.S. Posters by R.A.'s.

AN important step forward in industrial art has been taken by the London Midland and Scottish Railway in commissioning members of the Royal Academy to design posters of places and industries on their line. Many of these posters are nearing completion. Mr. George Henry, R.A., has done Edinburgh; Sir David Murray, R.A., Conway Castle; and Sir Bertram Mackennal, R.A., a most interesting plaque in low relief of an allegorical figure. Mr. D. Y. Cameron, R.A., is doing a Highlands poster, and Mr. George Clausen, R.A., will do the coal industry. An express engine-driver and his mate on one of the most modern of the company's locomotives are being depicted by Sir William Orpen, R.A. These are but a few examples of the work already in hand, for as many as 17 members of the Royal Academy are engaged on the work, the full list being :—Mr. Frank Brangwyn, R.A.; Mr. J. A. Arnesby Brown, R.A.; Mr. D. Y. Cameron, R.A.; Mr. G. Clausen, R.A.; Mr. M. Greiffenhagen, R.A.; Mr. George Henry, R.A.; Mr. Richard Jack, R.A.; Sir David Murray, R.A.; Mr. Julius Olsson, R.A.; Mr. Charles Sims, R.A.; Mr. Adrian Stokes, R.A.; Sir Bertram Mackennal, R.A.; Sir William Orpen, R.A.; Mr. Campbell Taylor, A.R.A.; Mr. F. Caley Robinson, A.R.A.; Mr. Augustus John, A.R.A.; Mr. A. Talmage, A.R.A.

Origin of the Scheme.

THE movement has developed from a step taken a few months ago, when the railway company asked Mr. Norman Wilkinson, the marine painter and the originator of naval camouflage during the war, to do three posters for them. Some years ago Mr. Wilkinson designed one of the Irish Sea service for the old London and North Western Railway, which achieved a good deal of success, and he has always taken a great interest in the improvement of posters. Here, then, was his opportunity. When he talked the matter over with the railway authorities he pointed out that, in his opinion, the time had come for a definite poster policy to be adopted. The company at once realised what an excellent idea it was, and practically decided then and there to adopt the scheme, and Mr. Wilkinson was asked to undertake the work of organisation and to invite artists to co-operate, with the result indicated. The ruling principle is thus stated: No pains will be spared in the reproduction of these posters. The railway stations provide an excellent opportunity of exhibiting them, and form what is in effect a great outdoor gallery, seen by thousands of people daily, on which should appear the best work obtainable. The railway company will indicate the places or subjects they desire to advertise, after which it will be left to the individual artist to carry out the design in exactly his own way. Each artist's name and diploma will appear legibly printed below his design. The posters themselves will contain no lettering on the pictorial portion, and very little on the border.

Beyond indicating the place or industry that they wish to advertise, the London Midland and Scottish are giving the artists an entirely free hand. There is another important question, that of reproduction in poster form. The company are quite alive to that, and neither money nor trouble will be spared to ensure the best reproductions possible of these notable contributions to every man's open-air picture gallery.

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A Runaway Freight Train.

THE principal feature of the collision between a London Midland and Scottish freight train and wagons in a dead-end siding which occurred at Ramsbottom, on August 17, was the failure to stop at the summit before descending the 5½-mile down grade, and apparent misunderstanding in regard to the use of the bank engine which had so far assisted the train. The 0-6-0 tender engine No. 444 had a heavy train of 57 wagons and a 20-ton brake van, 610 tons, and had been assisted by 0-8-2 tank engine No. 1501 as banker. There was a slight drizzle, making the rails somewhat greasy. Reporting upon the accident, Lieut.-Col. A. H. L. Mount comments upon the long immunity from failure of this nature, so far as the operation of traffic down this particular bank is concerned. Difficulty in allocating responsibility was found in regard to evidence as to the whistle indications that the train was out of control. Apparently, had the signalman realised the situation more promptly and advised the runaway by bell signal instead of telephone a minute earlier, the signalman at Ramsbottom could have cleared the level-crossing gates and allowed the train to run through Ramsbottom station, though even as it was, the Inspector leaves it open to question whether he could not have taken this action in time. However, while possible misjudgment on the part of the various signalmen is suggested, no blame is placed upon any of them.

The principal factor was, therefore, why the train was allowed to get out of hand. The train engine driver attributed his failure to stop at the summit to the fact that the bank engine continued pushing, and the Inspector suggests that marker boards to indicate the approach to the summit should be provided, though the varying lengths of trains introduces a difficulty. Blame is, however, placed upon the train engine driver for misjudging the weight of his train and "carrying on confidently in the hope that he would be able to regain control." The principal suggestion made by the Inspector was that a stop at the summit of this bank should be made compulsory for heavy freight trains, instead of being merely discretionary.

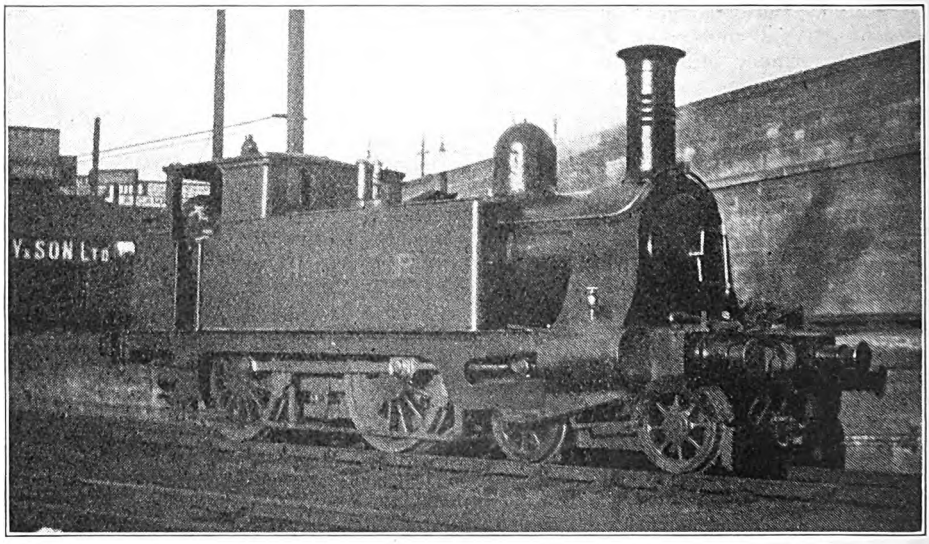

Photo.] [*R. D. Stephen.*

OLD HIGHLAND TANK ENGINE No. 50B AT PERTH.

Old Highland 4-4-0 Tank Engine.

A PHOTOGRAPH showing L.M.S. (Highland section) 4-4-0 tank engine No. 50B, recently engaged as a station pilot at Perth (General) station, has been sent in by Mr. R. D. Stephen, of Inverkeithing, Fifeshire. With regard to this engine Mr. E. L. Ahrons explains that it was originally No. 17 and named *Aberfeldy*. It was built at Lochgorm Works in 1879 as a 2-4-0 tank engine, having 4-ft. 9-in. coupled wheels and 16-in. by 24-in. cylinders. Nos. 58 and 59 were similar engines, also originally of the 2-4-0 type. Apparently, the single leading axles of all three engines gave some trouble on curves, and they were therefore altered to the 4-4-0 type. Heating surface is: tubes,

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820 sq. ft., firebox, 93 sq. ft. The original tanks accommodated 700 gallons of water, but are now enlarged to carry 850 gallons.

The British Railway System Explored.

WHILE we know of several readers who have travelled very extensively over the branches and by-ways of the British railway system, as well as the main lines, it is doubtful whether anyone besides our old friend and contributor Mr. T. R. Perkins, of Henley-in-Arden, has travelled over *every* section of line in Great Britain used at all by passenger trains. Indeed, while many railway officers have travelled over every section of their own lines, it is doubtful whether any one of them has explored the lines of another company with equal thoroughness. Therefore, as Mr. Perkins furnishes evidence of his travel exploits, and has, moreover, accumulated a great store of railway information in the course of his journeyings, we are prepared, in default of evidence to the contrary, to accept his claim without question. This achievement involves a total mileage of 18,546½, without counting duplicate journeys, or of some 65,000 miles of actual travel. Further, practically the whole of it has been made as an ordinary passenger, using tourist, alternative route, excursion and other facilities freely, but without official assistance. Further, as Mr. Perkins explains, most of it has been made at holiday periods, his business calling for little travel, and without sacrificing the recreation and recuperative value of a holiday as such.

In many cases railways which, even prior to grouping, had been amalgamated with other companies, were travelled over when separate concerns. Mr. Perkins' travels, therefore, cover 125 railways, 15 of which were independent when he explored them, 82 railways having their own locomotives and vehicles, 39 with no passenger rolling-stock, and 3 owning rolling-stock, but no locomotives. All this has been achieved since 1872, the highest new mileage in any one year being 1,566½ in 1909, and the lowest 91 in 1902, except that between 1872 and 1893 the total was only 839 miles, and in 1917 Mr. Perkins managed only a single half-mile of new ground. Since writing us the Hendon extension of the London Electric Railway adds a short section which must await his next visit to London.

Some Adventures.

OBVIOUSLY, in the course of his travels, Mr. Perkins has had a few adventures, though, as will be seen, nothing of any great moment. But it will be best to quote a few extracts from his remarks as follows :—

"Practically all has been as an ordinary passenger, as I have never asked for free passes ; but I have taken advantage of cheap tickets whenever possible. For instance, I once travelled 'tourist' from Birmingham to Dolgelley by Midland, via Worcester, Hereford, Three Cocks, Rhayader, Moat Lane, Aberdovey and Barmouth Junction ; another cheap ride was from Stafford to King's Cross by Great Northern Railway throughout ; while, for excursion runs, I think that marvellous pre-war half-day trip from Aberdeen to Boat-of-Garten and back was about my cheapest, especially as I returned in the dining-car by virtue of a 9d. tea !

"As far as accidents are concerned, my journeys have been most uneventful, three cases of engine failure being the only mishaps I have experienced, and even then I have not even missed any connection of importance through them. In fact, the only railway smash I have seen occurred here at home, when one Saturday midnight in 1911 an express excursion *en route* for Bristol was by mistake turned into the terminal bay at our station while running at 60 miles an hour down a 1 in 150 bank. The locomotive—a 4-4-0 of the 'Atbara' type named *Mafeking*—carried away the buffer-stops and mounted the cutting side, which gave way beneath it, so that it fell over on to its side across the up line and was wrecked, the motion being ripped out and frames crumpled like a child's toy. It was, in fact, taken to Swindon and scrapped. Fortunately, nobody was seriously hurt, the most damaged coaches being empty, and the brakes having been applied by the driver as soon as he found himself on the wrong road. I was fetched out of bed to supply necessary dressings and remedies [Mr. Perkins is a chemist.—ED. R.M.], and my assistant, being rather slight in build, was passed through the broken windows into the front coaches in search of possible killed or wounded, the doors being jammed and escaping gas preventing lights being taken there. Several times have I seen queries as to why *Mafeking's* number is blank, but have never seen the explanation anywhere."

Travel over New Ground.

"IF I haven't had any 'thrills' through being involved in accidents, I have experienced a good many of a more pleasurable kind. To see the rolling-stock of a railway for the first time has from boyhood been a red-letter event ; and as I had reached the age of 15 before seeing any other locomotives than those of the Great Western Railway and the London and North Western Railway,

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you can guess how excited I became at the prospect of a 2-mile trip on the Cambrian! True, the train when it arrived at Buttington consisted of a few carriages at the tail of a long string of goods wagons, but the engine had a leading bogie, an absolute novelty to me, of course. As for the coaches, the less said the better; but the journey was a new experience, and perhaps I may call it the beginning of that quest which was consummated by my trip over the Shortlands-Nunhead line a month or so ago, when I traversed the last bit of British railway that still remained to be covered. I had that old Cambrian Buttington to Pool Quay ticket for many years, but somehow managed to lose it before I began to collect tickets in real earnest."

Some Further Reminiscences.

"IN those days there was no RAILWAY MAGAZINE, or any other dealing with railways in a popular manner, and I hadn't the faintest idea what other companies' rolling stock was like. To a Londoner this may sound odd; but a country lad in those days didn't travel much, and although the Midland line at Bromsgrove was only a dozen miles from home I never saw a Midland train until I was nearly 18 years of age, nor did I travel in one for more than a year afterwards. Even to-day the romance of that journey (Birmingham - Droitwich) lingers in my memory; but I went down the Lickey incline and never knew of it!—a thing I have never ceased to regret. A few weeks later I walked from home to Bromsgrove station, arriving just as a passenger train was starting up, assisted by the usual banker in the rear; until then I had had a kind of idea that railways were all level (!) and the 'Lickey' was a startler, and no mistake. Perhaps that explains why that incline has attracted me ever since.

"My first two situations after leaving home were still on the two familiar lines (London and North Western and Great Western), but I managed to enlarge my horizon by a visit to Stafford, where for the first time I saw trains of the Great Northern and North Staffordshire Railways. I was greatly impressed by the unfamiliar outline of both Great Northern locomotives—Stirling ruled at Doncaster in those days—and carriages; to one accustomed to the 'two-colour' painting of Great Western and London and North Western stock, the plain varnished teak of Great Northern coaches appeared very quaint. But the Stafford visit had momentous issues; I noticed that the fare thence to King's Cross was the same as to Euston, and as opportunity for a visit to London 'on my own' shortly afterwards came my way, I resolved that my first visit to the Metropolis should be made by Great Northern route, a resolve that in due course was put into effect. The Stafford booking clerk vainly tried to dissuade me, and ticket collectors at points *en route* were inclined to be jocular; but to the budding railwayist the journey was a dream of delight, one of the only drawbacks being that we had from Grantham a 7-ft. 6-in. inside cylinder single instead of one of the famous 'eight-footers.'"

Round the London Termini.

"I HAD never even seen drawings of the engines or carriages of any of the southern railways, and it was with a keen sense of anticipation that I proceeded, on arrival in London, to visit the various termini. The 'Circle' provided the first of many exciting moments, when a Metropolitan train ran into King's Cross (Metropolitan): be it remembered, I had never seen outside cylinders on a tank engine, especially combined with coupled wheels and a bogie. At Waterloo I saw several express engines with the same wheel arrangement, and each terminus—for I visited all of them that day—had something fresh for me; perhaps the yellow colour and unusual appearance of the Brighton engines at Victoria remains most vividly in my memory. At Paddington I saw a 7-ft. 8-in. 'single' in its original six-wheeled condition; as the broad gauge had been removed the previous year, I missed seeing the famous singles of Gooch's design. I returned next morning by London and North Western Railway from Euston, and thus in less than 48 hours covered nearly as much new ground as in all my life before.

"Shortly afterwards I left the Midlands for the neighbourhood of London, and thus became acquainted to some extent with all the railways radiating thence; the outstanding railway experience of this period was a run by London and South Western excursion from Waterloo to the Isle of Wight, giving me my first acquaintance with the island railways. Our locomotive to Portsmouth was one of the long-obsolete 2-4-0 outside-cylinder type, with large dome on the fire-box, of which I never recollect having seen another before or since. It was characteristic, I suppose, that on the occasion of my only holiday while 'down south,' I should travel home by a new route; this time I booked 'tourist' from London to Droitwich by Midland, and got what was for me a record non-stop run—London to Leicester."

In Business in a Country Town.

"CURIOUSLY enough, although my home was on the Great Western line, I had never travelled to or from London by that route;

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on finally leaving London, however, I did so, and soon afterwards settled here, at the end of a short branch line, apparently with little prospect of much travel in the future. And yet, in spite of the claims of business, which have practically confined my opportunities for leaving home to an annual fortnight or so, I have succeeded in less than 28 years in covering the whole remaining portion of the British railway system, without encroaching on Sundays or neglecting my business. Neither have health and exercise been sacrificed to the claims of a mere hobby; with a little foresight, it has been easy so to arrange my holidays that I do not miss the objects of interest in the places visited, while by walking between branch termini or to avoid redundant journeys, I have frequently enjoyed not only healthful exercise, but delightful scenery as well. Many are the glorious walks that linger as fragrant memories, sometimes amid the wonderful churches of the Eastern Counties, at others over the moors and along the dales of Yorkshire, or yet again among the mountains and glens of Wales and Scotland, each in connection with the exploration of some hitherto unfamiliar line of railway."

Travel by Unusual Routes.

"THE quaint and the unusual in the railway world has always appealed strongly to me; hence many of the hackneyed routes were left untouched until others less generally known had been explored. For example, though I first visited Scotland in 1897, it was not until nine years afterwards, on my third visit, that I travelled for the first time by the familiar West Coast route, while the East Coast route remained unexplored for yet another seven years. Similarly, although I had visited Swansea by both Midland and London and North Western routes, and travelled to Carmarthen by the latter, it was some years later before I reached those towns by the 'obvious' route of the Great Western Railway. This preference for the by-ways of the British railway system has had its compensations; if I have not been able to 'clock' wonderful express runs, I have enjoyed many amusing experiences, and the planning out of a tour that is to include an out-of-the-way or little-used line often calls for the exercise of considerable ingenuity, with corresponding satisfaction when the object is safely achieved.

"It is wonderful how many lines there are, sections sometimes only a few hundred yards in length, over which it is most difficult to travel by passenger train. How many railwayists, for instance, have travelled by Great Central train over the Retford level crossing, or by the short cut avoiding Doncaster, by which in summer a daily train runs direct from Leeds to Cleethorpes? Or how many have travelled through the north curve at Ambergate, or by the original Grand Junction line avoiding Wolverhampton? Such journeys stir the blood, as did also a trip I once made by an excursion train from Pontypridd to Sully, which avoided Cardiff and travelled by the Radyr-Penarth direct line; or one by which I journeyed from Workington to Carlisle via Seaton and Linefoot, calling to pick up passengers at a derelict station (Great Broughton) where railings, &c., were falling to pieces, the line having long been closed to ordinary passenger traffic. The 'Whelley Route' of the London and North Western Railway, used by one train daily between Manchester and Preston, is another curiosity, especially as the train has to pass through a Great Central station on the way. Many more, over which I have travelled, are now closed to passenger traffic, while others, alas! little likely to be reopened, I missed when I had the opportunity. Just before its closing I travelled over a railway that has probably disappeared entirely ere this: the Hotwells branch of the Great Western and Midland Joint, which is being removed and a road built upon the site. I travelled over two horse-worked railways, now no longer possible—the Port Carlisle (North British Railway) and the Inchture (Caledonian) branches."

Speed and Time-Keeping.

WHILE a great deal is made of speed as a necessary factor in railway operation, it must be accompanied by punctuality, and in many cases passengers, other than speed enthusiasts, would prefer time-keeping at moderate speeds to bursts of high speed with uncertainty of arrival at destination. At the same time, many of the fastest trains, especially those of importance to business men, are among the most punctual, so that the issue comes down to that of practicable high speed and maintenance of schedules, both of which are now applied on the basis of fairly uniform rates of travelling over the stages of a journey, with only occasional instances of speeds much in excess, if at all, of 75 m.p.h. These aspects now apply on most railways in countries where high speeds are run, and, therefore, we join issue with a correspondent writing to our American contemporary, the *Railway Age*, who suggests, on the basis of some remarks apparently quoted from the RAILWAY MAGAZINE, that British railways are characterised by high speed for its own sake, and that it is sometimes appraised more highly than the maintenance of schedule times stage by stage and from end to end of a journey. The

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remarks quoted came from a reader in the United States, comparison being made between a Pennsylvania train which, on a parallel section of route, was passed, while travelling at 65 m.p.h., "standing still," by a Jersey Central train making over 80 miles per hour. Obviously, the description requires some latitude of interpretation, and indicates merely that while one train was travelling fast, the other was going even faster. Necessarily, too, it does not follow that either was doing anything exceptional, or more or less than its schedule called for. There are instances, indeed, on British railways where one express passes another which also may be travelling at high speed. But any inference that high speed is favoured apart from schedule requirements is as incorrect in reference to British railways as to those in the United States, France or other countries where high-speed expresses are run. And certainly neither in England nor elsewhere is safety sacrificed to speed.

Punctuality at a Great Terminus.

MR. C. V. MARSDEN sends some notes summarising his observations on a recent day at Euston when, in the course of three hours, every express except one arrived either punctually or early. His notes may be summarised as under :—

From.	Time Due.	Time Arrived.	Load, Tons.	Class of Engine.
Northampton	11.40 a.m.	11.38 a.m.	180	A.
Trent Valley	11.55 ,,	11.52 ,,	265	A.
Liverpool and Manchester	12.5 p.m.	12.5 p.m.	370	C.
Lichfield	12.32 ,,	12.29 ,,	132	E.
Wolverhampton	12.40 ,,	12.40 ,,	190	A.
Manchester	12.50 ,,	12.46 ,,	225	C.
Birkenhead and Chester	1.0 ,,	1.0 ,,	180	A.
Manchester	1.15 ,,	1.14 ,,	370	A, D.
Birmingham	1.25 ,,	1.25 ,,	270	A.
Liverpool Boat Special	1.40 ,,	1.40 ,,	315	B.
Liverpool and Chester	1.45 ,,	1.45 ,,	380	A.
North Wales	2.20 ,,	2.22 ,,	365	C.
Liverpool Boat Special	2.40 ,,	2.40 ,,	340	B.

A. "George V." class. B. "Prince of Wales" class. C. "Claughton" class.
D. Converted Webb compound. E. "Precursor" class.

It is pointed out that the train due at 2.20 p.m. had a special stop to pick up Stonyhurst College carriages, and this probable accounted for its lateness. The second Boat Special left the Riverside station, Liverpool, at 10.50 a.m., and as engines had to be changed at Edge Hill, this represented a very good run.

Travelling in Central Europe.

IN sending several photographs taken during journeys in Central Europe last summer (one of which is reproduced), "B.A." supplies also some comments based upon his observations, from which the following quotations may be made :—

"One has to put up with a lot of red tape; for instance, between Buda Pesth in Hungary and the Austrian frontier, a distance of some 120 miles, our passports were examined five times. Again, at one point in the Rhineland we touched French occupied territory, and a French soldier walked down the train looking at passports, and when he had left, another started where the first one had finished, going through the whole performance again. Meanwhile, the train was kept standing 45 minutes for this somewhat childish performance. In Germany trains were, owing to the great lack of coal, very few in number and quite inadequate for the number of people wishing to travel. The rolling-stock seemed in reasonable condition, but the locomotives were in an appalling state. They were red with rust and most of them looked positively dangerous. In the Rhineland the chief passenger work was done by 0-10-0's, and the usual train seemed to be about 17 coaches, that is well over 700 tons, hence the running was not very fast, and banking was in force constantly. All the sidings in the Ruhr were stacked with wagons, as the French would not allow any that came in with foodstuffs, &c., to go out again. Moreover, owing to the occupation many trains were compulsorily diverted. For instance, before the occupation there were about nine trains a

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day between Cologne and Nürnberg, running direct via Mayence, but at the time of my visit there were only two, and these travelled north to Elberfeld, thus taking 15 hours as opposed to 10. It can easily be imagined that two trains would not do the work of nine, and it was advisable to be at the station in plenty of time, otherwise one might not even have the satisfaction of seeing the train, far less getting on to it. In the French occupied area the lines round the big towns were guarded by troops, African ones being largely used for this purpose. Fares were very cheap, but one had to be constantly on the look out for increases. One day when I had little time to catch my train at Salzburg, I was informed that since I had taken my ticket there had been a 300 per cent. increase, so I had to pay 130,000 marks extra—at that time quite a lot."

0-6-0 TANK ENGINE, SWISS FEDERAL RAILWAYS, AT BERNE.

Bavaria and the Rhineland.

"THE lines in Bavaria were in much better order than those in Rhineland. There was a coal shortage, but beyond suspending some of the fastest expresses, they were working more or less normally. Their track was in excellent order and the carriages excellent and clean. The chief passenger work was done by 4-6-0's and 4-6-2's; the goods by 2-6-0's and some new 0-10-0's built by Maffei, of Munich. In passing it is worth mentioning that there is a splendid railway museum at Nürnberg. It contains beautiful scale models of all the Bavarian State locomotives, past and present, besides many details of the railway working, working time-tables, &c. In Austria the track was not so good, and some of the trains were very crowded. Restaurant cars were not at all plentiful and were not running even as advertised, except on the through expresses. Punctuality was not known at all."

Hungary and Italy.

"IN Hungary the rolling-stock was very bad, and even on the main Buda-Pesth to Vienna line the track was appalling. Many interesting old types of locomotives were to be seen, such as old 4-4-0 tandem compounds. In the Tyrol, before 1919 Austrian, and now Italian, the old Austrian stock was still used. Indeed, the only difference that could be seen was that Italian names had been given to the stations. This was very confusing, as the porters were still really Austrians and called the places by their original names. The war has created some interesting light railways in this district. One of these is the line from Dobbiacio (Toblach) to Cortina. This was constructed during the war by the Austrians for carrying supplies to their front, and is a wonderful piece of engineering. Steep gradients and very sharp curves are the rule, as it winds its way along precipitous mountain sides, with evidences of the war on every side.

"In Northern Italy most of the main lines are now electrified and seemed invariably to keep better time than the steam trains, although the loads are not very great. These compared unfavourably with the Swiss lines, where time is always kept. On the

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mountain railways in Switzerland the fares struck one as prohibitive after travelling in Germany, but one cannot expect to travel for 13 hours, first-class, in an express, including the express supplement for 11*d.* everywhere! What does strike one in travelling in Central Europe is the extraordinary courtesy with which the officials treat a foreigner, and as a general rule their willingness to help."

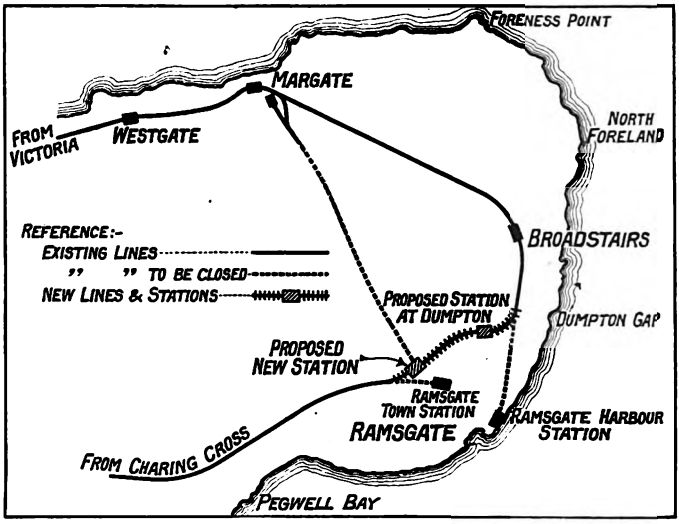
New Stations in Thanet.

AFTER a pause of 25 years there is a probability that the trains of both sections of the late S.E. & C.R. will work to and from one station at Margate as contemplated by the Working Union Act of 1899. In connection with the scheme, Ramsgate also is promised by the Southern Railway a new station in substitution for the present termini. At Margate the old L.C. & D. (or West) station was some years ago rebuilt to accommodate the traffic of both sections, though the necessary connecting spur was not constructed; there is a connecting siding.

Apparently the scheme will involve the abandonment of the section of double line railway between Ramsgate Town and the Margate Sands station. The section of the Kent Coast Railway between a point near the Broadstairs mouth of the Ramsgate tunnel and the Ramsgate Harbour terminus will also be abandoned. The location of the Harbour station, although admirable for excursion and waterside traffic, is much confined and cannot be extended.

The proposed new railway includes a line across the suburbs of Ramsgate from the east of Broadstairs, &c., to a point near Whitehall Junction where the St. Lawrence loop joins the Ramsgate Town—Margate Sands line. A new station will be erected near Whitehall Junction to serve Ramsgate.

The construction of the Ramsgate station at the spot indicated will enable trains to run from London to London via Faversham, Margate West, the new Ramsgate station and Ashford, and *vice versa* without reversing. An advantage of the scheme is the abandonment of the awkward section for up trains from Ramsgate Harbour through the tunnel on a rising gradient of 1 in 75 for about 1½ miles.



PROPOSED RAMSGATE AND MARGATE IMPROVEMENTS, SOUTHERN RAILWAY.

Travel on American Railways.

MR. G. G. BEAMISH, now of Morristown, New Jersey, after experience of extensive travel on American railways, passes some interesting comments in regard thereto, as seen by one hitherto familiar with British practice. In reference to trans-Continental trains he points out that it is unfair to compare the service on such journeys with anything in England, owing to the great difference in conditions. He has found the ordinary standard steel Pullman sleeping cars, which weigh about 70 tons, very comfortable to travel in, even over the roughest track, provided that speed is not too great. At high speeds, however, they sometimes tend to rock and sway considerably. He considers the standard American coupler as a distinct advance upon British methods, though, unless carefully driven, trains so coupled can be made exceedingly uncomfortable. "Trains are sometimes started with a jerk which can throw a man down." The best American practice, as, for example, on the Pennsylvania main line between New York and Philadelphia, is very good, and the heavy Pullman cars ride on such track "more smoothly than any train in which I have ridden in England." "On the other hand," continues Mr. Beamish, "I think the Board of Trade would swoon at the sight of some 'main line' track in the south and west." He suggests that the system of staggered rail joints may make for smooth running at low speeds, though he considers it a probable cause of severe lateral oscillation at high speeds.

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Operating Conditions.

COMMENTING upon the large and powerful locomotives necessary to deal with trains of the weights usual in the United States, Mr. Beamish suggests that the standard of maintenance is not nearly so high as in Great Britain, while locomotive failures are relatively more common. "The most interesting locomotive work on passenger trains is to be found in the mountain divisions of the trans-Continental lines. The absence of really high speeds on the easy lines makes travelling in the east much duller than journeys over similar lines in England. Main line electrification has made great strides. Especially interesting are the two divisions of the Chicago, Milwaukee and St. Paul Railway over the Rockies and the Cascade Mountains. I travelled in the 'Olympian,' the fastest through passenger train, which was handled over the Rockies by a quill-drive engine of the 4-6-2-2-6-4 wheel arrangement. The train, consisting of 12 steel cars and an observation car, was stopped by signal on a sharp curve on a grade of 2 per cent. just east of the Continental Divide. Without a sign of slip or effort the train was re-started and travelled over the summit at 25 m.p.h."

Old Stations with New Names.

GROUPING of the railways has resulted in many stations being re-named. This is particularly the case when different stations of the same name formerly on separate railways are now on the same system. In some cases distinction has been effected by adding the name of the county to the place name, in others by the addition of prefix or suffix. In many cases, particularly where the places are small, the name of the station has been changed entirely, usually to that of an adjacent village, of about equal importance with that which gave the superseded name to the railway station.

In a list of changed names of stations on the L. & N.E.R. the following are noted: Burgh (late N.B.) becomes Burgh-by-Sands, and Burgh (late G.N.) is now Burgh-le-Marsh, whilst Belton (G.E.) has " & Burgh " added to distinguish it from another wayside station on the L. & N.E.R.—Belton (G.C.). Enfield (G.N.) has become Enfield Chase, Carlton (N.E.) has changed to Red Marshall—a village 1¼ miles distant, with a population of 55, with the idea of preventing the Durham Carlton (with 251 inhabitants) being confounded with its Yorkshire namesake (population 753) on the late Hull & Barnsley Railway. Junction Road, Edinboro' (N.B.) is now Junction Bridge, because late G.E. trains serve Junction Road on the T. & H.J.R. Newport (H. & B.), perhaps the most unimportant of the eight stations named Newport, becomes Wallingfen, to distinguish it from another Yorkshire Newport (N.E.) almost as unimportant. Park (G.E.), which has always appeared to us to be an incomplete name, is now Northumberland Park, which place has always been meant, although the latter part of the title only has been employed. Park (G.N. of S.) retains its appellation after inclusion in the L. & N.E.R. Stow (G.E.), a Norfolk representative of the numerous places so named, adds Bardolph, and leaves Stow (N.B.) to be the L. & N.E.R. representative of the family. Finally, we have Wells (G.E.) renamed Wells-on-Sea, although we know of no other Wells on the L. & N.E.R. By the way, the real name of the Norfolk Wells is Wells-next-the-Sea, which is more truthful and more picturesque nomenclature. If our memory be not at fault it certainly is not " on sea "—even at high water ordinary spring tide.

A 438-Mile Non-Stop Run.

WHILE this performance has, on a number of occasions, been referred to in British railway publications, it is probable that a large proportion of our readers are unaware of the fact that in one instance a distance of no less than 438 miles was covered in each direction without a stop. For this reason, therefore, we welcomed an authoritative description by Mr. Geo. L. Fowler, published in the October number of our American contemporary, *Railway and Locomotive Engineering*. The journey was made as far back as 1876, Messrs. Jarrett and Palmer, the then leading theatrical managers in New York, desiring for purely advertising purposes to have their opera company taken from New York to San Francisco, 3,313 miles in 84 hours. The Pennsylvania Railroad agreed to assist in the matter, and decided that it, too, should obtain some benefit in regard to publicity, and that the journey should include a run from Jersey City to Pittsburgh, 438 miles, without a stop. The main problem was how the locomotive could be furnished with sufficient coal and water, and to provide for attention, should any part run hot, without stopping. Water troughs existed, it is true, but they were located to meet the needs of each division, and there were long sections without them, their allocations being unsuitable for a through journey. Hence, it was necessary to carry an additional water supply, as well as sufficient coal for the throughout journey. A baggage and combination car carried the additional supplies, water being taken from track tanks wherever practicable, drawing upon the stock in the baggage car at other times, coal being passed from the baggage

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car to the tender as the original supply there became depleted.

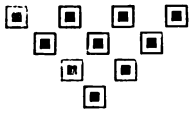
A Dress Rehearsal.

THE locomotive—a 4-4-0 of that period—was taken from service, the then superintendent of motive power, Mr. Theodore N. Ely, considering it better to take an engine in ordinary running trim in preference to one fresh from the shops. On the same principle no special attention was given to it in the way of repairs, overhauling, valve re-setting or readjustment of bearings, his theory being that there was no reason why a locomotive which had been running for a long time satisfactorily should not so continue to run, whereas one which had just been overhauled might suffer from ailments so common to locomotives just out of the shops. The engine was one belonging to the Pittsburgh division, and it was decided to have a "full dress rehearsal" by running the train from Pittsburgh to Jersey City without stopping, before undertaking the principal journey. In this direction, starting from Pittsburgh at 6 a.m., Jersey City was reached late in the afternoon. The principal trip, with the opera company on board, was commenced a few minutes after midnight, the run to Pittsburgh being made in 10 hours 5 min., average 43½ m.p.h. On both runs a pilot driver for each division was in the cab, the driver, William Phillips by name, obviously being unfamiliar with the line throughout. Nothing sensational in the way of speed was apparently attempted, though, in going west, a defect which developed in the brake mechanism, in descending the western slope of the Alleghenies, caused the descent to be made at an unduly high speed, though without untoward results. On the trial run one of the pilot drivers failed to notify Phillips of a 5 deg. curve at one place, with the result that this was rounded at a speed which might have proved dangerous. Mr. Fowler does not give details of the load, though, obviously, this could not have been heavy. As an achievement, however, this performance still appears to rank as a world's record, though no doubt it could be equalled or excelled with comparative ease in these days were there any necessity or justification therefor.

1,138,670 miles and a Mishap.

MAJOR HALL'S report to the Ministry of Transport in regard to the accident which occurred on October 8, between Ravenstonedale and Gaisgill on the Tebay branch of the North Eastern section of the London and North Eastern Railway, is principally of interest owing to the age of the engine concerned and the record of work done. The locomotive was No. 366, a 2–4–0 with 18 in. by 24 in. cylinders and 7 ft. coupled wheels. It was built in 1880, since which time its total mileage has amounted to 1,138,670. For a number of years it has, of course, not been engaged on main line duties, and was one of six or seven engines normally stationed at Barnard Castle for working branch lines radiating therefrom. The accident was due to fracture of the right-hand connecting rod and penetration of the right-hand bottom corner of the firebox. The driver was badly scalded and the fireman fell from the footplate and broke his collar bone, in addition to being scalded. The engine was damaged in various ways, as also the permanent way.

So far as can be traced, the wrought-iron connecting rods were those originally fitted to the engine. The accident occurred at a speed of about 35 m.p.h. The inspector attributes the accident primarily to the breaking of the right-hand cross-head cotter, which was, apparently, not a good fit and had been considerably over-driven. The opinion is therefore expressed that it had worked upwards and become loose enough to allow sufficient play between the piston rod and crosshead to cause a fracture, which, when the breakage occurred, probably coincided with the upper edge of the piston rod. The fracture of the cotter caused an obstruction to the free movement of the connecting rod, the fracture of which therefore resulted from the bending strain so set up. The fracture of the connecting rod was therefore not a primary factor in the case. The only recommendation made by the inspector is that the shed fitting staff should be reminded of the importance of well-fitting cotters in vital parts of the motion, and particularly of the necessity for replacing them when they have become sufficiently worn to permit of their being over-driven.



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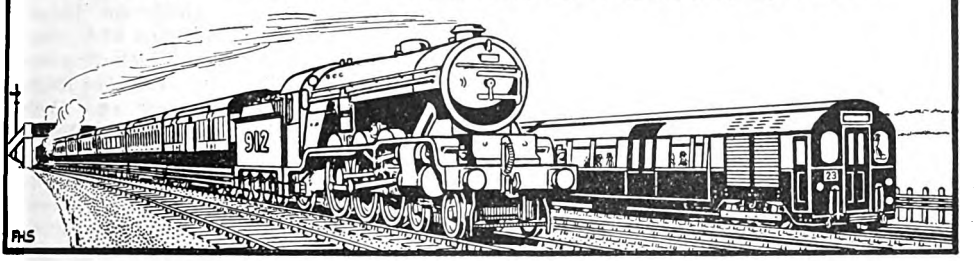
WHAT THE RAILWAYS ARE DOING.



As usual the railway industry received its recognition in the distribution of New Year's Honours. The recipients for 1924 were as follows :—

Viscount :—Baron Inchcape, G.C.M.G., K.C.S.I., K.C.I.E., Director of the Great Western Railway.

Barons :—Right Hon. Sir Frederick George Banbury, Bart., M.P., Chairman 1917–22, and for over 20 years a Director of the Great Northern Railway. Colonel Sir Herbert M. Jessel, Bart., C.B., C.M.G., Director of the London, Tilbury and Southend Railway, 1905–12, and of the Midland Railway, 1915–22.

Privy Councillors :—Hon. Henry Burton, K.C., Minister of Finance, formerly Minister for Railways and Harbours, Union of South Africa. Baron Colwyn, Director, Underground Electric Railways Company of London Ltd.

Knights :—Mr. John Ernest Jackson, C.I.E., Acting Agent, Bombay, Baroda and Central India Railway. Mr. Harry George Waters, Principal Medical Officer, East Indian Railway. Mr. Arthur Watson, C.B.E., LL.D., General Manager, London, Midland and Scottish Railway.

C.M.G. :—Hon. John Scaddan, Minister for Mines, Railways, Industries and Woods and Forests, Western Australia.

C.I.E. :—Mr. George Deuchars, lately Government Director of Indian Railway Companies, India Office. Mr. Ernest William Proctor Sims, Manager and Engineer-in-Chief, Junagadh State Railway.

M.V.O. (4th Class) :—Major Henry Angus Watson, C.B.E., who retired at the end of last year from the position of General Superintendent, North Eastern Area, L.N.E.R. Mr. Thomas Fell Molyneux, O.B.E., formerly District Passenger Superintendent, Waterloo, L.S.W.R.

* * *

MR. A. P. PARKER,

Assistant to the Divisional General Manager, Southern Area, London & North Eastern Railway, 1919–1923.

Sir Percy Crosland Tempest, K.B.E., retired on December 31 from the position of Joint General Manager of the Southern Railway Company, following his service as General Manager to the South Eastern and Chatham Railways' Managing Committee since early in 1920. Previously he had held office as Chief Engineer to the Managing Committee since his appointment in 1899, continuing to exercise oversight of the Engineers' Department until the end of 1922, in combination with his duties as General Manager. He also held the position of Engineer to the Channel Tunnel Company, to which he was appointed in 1916. In recognition of important services during the war he received the C.B.E. in 1918. He was made an Officer of the Order of Leopold by the King of the Belgians in 1919, and a Chevalier of the Legion of Honour by the President of the French Republic in 1920, while the Birthday Honours of 1923 included his further appointment as Knight Commander of the Order of the British Empire. Sir Percy Tempest will continue to be Engineer to the Channel Tunnel Company,

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and we are informed that his services are being retained in a consultative capacity by the Southern Railway.

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MR. ALEXANDER P. PARKER, who retired on December 31 from the position of Assistant to the Divisional General Manager, Southern Area, London and North Eastern Railway, had been 30 years in the service of the Great Eastern Railway, when in 1902 he became Private Secretary to the then General Manager, Mr. J. F. S. Gooday. In 1914 Mr. Parker was appointed by Sir Henry Thornton, Chief Clerk to the General Manager. Then came the war, and in the absence of his chief on military service, Mr. Parker had to represent him to such an extent that his appointment early in 1919 as Assistant to the General Manager was really official recognition of the duties he actually performed. Throughout his long service Mr. Parker took an active part in the social and recreative activities of the Great Eastern Railway staff. He also was Editor and Manager of the company's staff magazine. On the formation of the London and North Eastern Railway in 1923 Mr. Parker became Assistant to the Divisional General Manager of the Southern Area, from which position, as announced above, he has now retired, highly esteemed by all associated with him.

* * *

RECENT railway obituary includes Sir Ernest Paget, Bart., who was first made a Director of the Midland Railway in 1870, and became Deputy-Chairman in 1881. Ten years later he was elected Chairman, and he retained that position with great credit until his retirement in 1911. He retained his seat on the Board until the close of 1922, when the Midland Company became merged into the London Midland and Scottish Railway.

* * *

MR. A. W. BOLDEN, Managing Director and Secretary of the Antofagasta (Chili) and Bolivia Railway Company, has relinquished the office of Secretary, and will in future confine his attention to his duties as Managing Director. Mr. A. H. Clinch has been appointed Secretary as from January 1.

* * *

MR. CECIL J. ALLEN, who needs no introduction to RAILWAY MAGAZINE readers, is booked to speak at the London Broadcasting Station at 9.10 p.m. on Friday, February 8. His subject will be "Safety in Railway Travel."

AT Bishopsgate Institute on January 8 Mr. H. F. Hilton, Chairman of Committee, Great Eastern Lecture and Debating Society, read a paper on "Branch Lines of Railways, their Equipment, Working and Development." Mr. P. Syder, London Divisional Commercial Superintendent, Great Eastern Section, Southern Area, London and North Eastern Railway, presided, and there was a large attendance. The paper, which was illustrated by lantern slides, was followed by an animated discussion. The speakers, in addition to the Chairman, included Messrs. R. A. Newman, G. Keary and J. F. Gairns.

* * *

THE third annual Bohemian Concert arranged by the Institute of Transport Metropolitan Graduate and Student Society was held on January 10, at Cannon Street Hotel, and, although the attendance was not quite up to expectations, owing to the very bad weather, the function was in every other respect eminently successful. Sir Joseph Broodbank, President of the Institute of Transport, telegraphed that he was "snowbound" in the country. Mr. H. H. Gordon, J.P., a Vice-President of the Institute and the first chairman of the Society, therefore presided in his stead, supported by Mr. A. Winter Gray, Secretary of the Institute, Mr. T. A. Kenyon, M.B.E., M.Inst.T., and other members of the Committee of the Society. A particularly fine entertainment was given by the artistes engaged, nearly every item being encored. During an interval, Mr. Gordon referred to the progress of the Society, which now includes about 200 members, and to the services rendered by the entertainment sub-committee and the officers of the Society, of which Mr. A. J. Webb is Hon Secretary., assisted by Mr. H. G. Coe. Mr. E. W. Bayliss, Vice-Chairman of the Society, responded. Later, Mr. F. O. Waite, Chairman, proposed a vote of thanks to Mr. Gordon, to which the latter suitably replied.

* * *

MR. E. W. BEATTY, President, Canadian Pacific Railway, sent the following New Year greetings to his staff—now some 100,000 in number :—

"To All Officers and Employees. The ideals of courtesy and efficiency on which Canadian Pacific service is based have been maintained to the fullest extent during the past year, and I desire on behalf of the management and of myself to thank all officers and employees for their admirable record. The great harvest of the West and the prospects for increased immigration justify us in anticipating continued prosperity for

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1924. That prosperity depends so much on adequate and efficient transportation that it behoves every one of us to strain every effort to meet the anticipated demands of the public. The closing month of the year that has passed was saddened by the death of our Chairman, the late Lord Shaughnessy, to whose forty years of splendid service the established strength and worldwide growth of the Canadian Pacific Railway are largely due. His magnificent achievement should be an inspiration for all of us in the years to come. I extend to all of you and to the members of your families my best wishes for a New Year filled with happiness, prosperity, and health."

* * *

MODEL railway enthusiasts in the south-western suburbs of London are forming a local Model Railway Club. Mr. R. Sheppard, 27, Bernard Gardens, Wimbledon, is the moving spirit, and will gladly furnish full particulars to miniature railway and model locomotive votaries resident in the neighbourhood.

* * *

EVERY year at the Model Engineering Exhibition the stand of Messrs. Bassett-Lowke Ltd., of London, Northampton and Edinburgh, is a considerable centre of attraction. This year its proportions were greater than in 1923 but the general arrangement was much the same. That the firm's activities are not restricted to model railways and locomotives was brought home to the visitor by the fact that the centre of the stand was occupied by a magnificent model of the R.M.S.P. Co.'s s.s. " Almanzora " built to a scale of $\frac{1}{8}$ in. to the foot. The model was over 6 ft. long and was the most striking piece of model work in the Exhibition. It is the first of eight that are being built by the firm for the R.M.S.P. for the British Empire Exhibition at Wembley and their branch offices.

In railway models the most notable exhibit by this famous firm was that of the $2\frac{1}{2}$ in. gauge $\frac{1}{2}$ in. scale locomotive " Challenger." This engine in its trial tests hauled behind the tender a load of 476 lb., equivalent to a scale train of 460 empty wagons or 161 loaded wagons! The " Challenger " is claimed to be the most powerful $2\frac{1}{2}$ in. gauge methylated spirit-fired locomotive ever built.

Other model steam locomotives for Gauge 1 were :—

A model of the London and South Western Railway 4–6–0, class No. 736, with bogie tender, fitted with a special design of valve motion. This motion is in effect a simple eccentric motion operated from a return crank. The movement is transmitted through a vibrating lever so that as a whole it approaches in appearance the Walschaerts gear of the prototype. The gear was designed by Henry Greenly for this purpose. Another was a model of the Great Western Railway 4–6–0 " Titley Court," of similar construction, but, of course, without the special valve gear.

Messrs. Bassett-Lowke also exhibited a number of examples of wood rolling stock, including the transferred wood wagons which for realism are unsurpassed, but at the same time are sold at a reasonable price. A number of the firm's railway fittings, signals and engine sheds were on view, together with a splendid range of fittings for glass case ship models. Mention must be made of the fine craftsmanship shown in the 50 ft. to the inch waterline models of the " Leviathan," " Majestic " and " Almanzora," built for the Southern Railways' Dock Model, together with examples on the same scale of English and foreign warships.

Following the usual practice of Messrs. Bassett-Lowke Ltd., goods were not offered for sale, but customers were referred to the firm's London Branch where a full range of all their goods, with the exception of castings, is kept in stock. An innovation was made in this respect by the firm having for sale their new series of miniature railway posters. These were a novelty and the model hoardings, with a selection of these reproductions in their accurate colours, were subjected to much favourable comment. The posters are made up in packets of two dozen or more and are sold for the modest sum of 9d.

* * *

MR. R. BELL, Assistant General Manager, London and North Eastern Railway, occupied the chair at a conference on railway geography, held under the auspices of the Geographical Association, at the Birkbeck Institute, London, on January 4.

Mr. L. Rodwell Jones, M.Sc., Cassell Lecturer in Economic Geography in the University of London, read a paper, in which he showed the powerful influence of railway construction on the location of industries and the development of agriculture. It enabled millions to live in a restricted area and draw their supplies from enormous distances. He drew most of his illustrations from America, but pointed out how the successful establishment in this country of an industry like the manufacture of sugar from beetroot largely depended upon good railway communications.

Mr. C. B. Fawcett, B.Litt., M.Sc., of Leeds University, followed with a paper which urged upon geographers the need for detailed study of particular regions such as the West

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Riding of Yorkshire. Mr. Fawcett contrasted Leeds and Middlesbrough. The wealthy inhabitants of Leeds made the Leeds Northern line in order to get an outlet to the North for their manufactures, whereas Middlesbrough owed its existence to the determination of the Stockton and Darlington Railway to have a place for coal shipment on the River Tees. Mr. Fawcett said 16½ millions of our population lived in the suburbs of seven grouped cities, and they would die of starvation were they deprived of the railways. A railway was one of the facts of human geography. It was a complex tool developed to serve the need for bulk transport. It influenced the position and size of towns and had been an important factor in a redistribution of population.

* * *

IN the course of his paper on "Inland Waterways," read before the Institute of Transport on January 7, Mr. E. Manning Lewis, referring to railway grouping, stated that, in the opinion of a large number of commercial men, it would result in four huge railway and dock monopolies, dividing the whole of the United Kingdom between them and each operating only in its own area. At the present time there was, no doubt, a certain amount of overlapping, but it was most likely that, by negotiation, the area of each group would be distinctly defined and competition with other groups would be thereby eliminated. It should also be borne in mind that certain of these railways had obtained Parliamentary powers to act as common carriers by road, although others had since been refused similar powers. Had the application of the latter been successful there was little doubt, in his opinion, that the private carriers would have been gradually forced off the road. Under the circumstances, therefore, it would appear of the utmost importance to traders that there should be adequate alternative means of transport. There appeared to him to be no reason why both railway and canal interests could not be worked together, and an arrangement arrived at whereby the heavier classes of traffic would be carried by water, as on the Continent, where railway road and waterway each had its special place in the transportation system.

* * *

FOLLOWING the fact that the South Eastern and Chatham and London, Brighton and South Coast stations, at Victoria, now form part of the Southern Railway, and have been placed under one stationmaster and staff, steps are being taken to break down the relative isolation which existed. As a preliminary, an opening has been made in the separating wall, so that it is no longer necessary for passengers to go first to the courtyard to pass from one to the other. Alterations are to be undertaken to provide running connections between the approach lines of each section and either portion of the station (present connections provide only for exchange traffic), so that trains on any route can be dealt with as found desirable. It is proposed to concentrate all Continental traffic in one section of the station, and other traffic classification arrangements will follow. It is intended to lengthen the platforms of the South Eastern and Chatham section outwards both to enable longer trains to be accommodated and to permit of the circulating area being increased. The whole of the combined station will be rearranged, and the South Eastern and Chatham portion made to correspond with the Brighton section. All platforms will be numbered consecutively. The Brighton station has 9 platforms, all designed to accommodate two trains each, so that they are equivalent to 18. To these the South Eastern and Chatham section adds 9 platforms, so that there are practically 27 platforms in the combined station. Among other contemplated improvements are a new cab approach from Eccleston Bridge. Other stages must, perforce, be taken in hand by degrees, so that for the present the benefits will consist mainly of easier intercommunication between each section, and unified operation under a single staff.

* * *

A RECENT topic of discussion in railway circles has been the decision of the Italian Courts in a case against the International Sleeping Car Company. A passenger using a sleeping berth sued the company for compensation for articles stolen during the journey. The company contended that it could not be held liable for risks other than those entailed by a public carrier's contract. The Court, instead, held the view that, as the traveller had to pay a special supplement for using the companies' facilities, its liability should be similar to the provisions of the Innkeepers' Act, there being in the case two separate contracts, one with the State Railways for carriage and the other with the International Sleeping Car Company for providing sleeping facilities.

* * *

RAILWAYS were among the chief sufferers from the January flooding of the Seine in Paris. The Paris-Orléans terminus opposite the Louvre, known as the Gare d'Orsay, had to be closed early, and traffic on the underground line which connects the Gare d'Orsay with the Gare d'Austerlitz, on the

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left bank of the river, ceased. The Chemin de Fer de l'Etat was compelled, similarly, to close the Gare des Invalides and suspend traffic on the electric line which runs westwards along the left bank to Versailles. Owing to the collapse of a sustaining wall on the riverside the water finally poured into the station, which lies below the surface of the ground, and converted it into a lake from which alone the tops of the signals emerged. The water at the height of the flood was about 10 ft. deep. There was no loss of life or damage to rolling-stock as the station had been evacuated some days before the wall gave way. Elsewhere in Paris the underground systems, apart from some infiltrations, remained immune. The

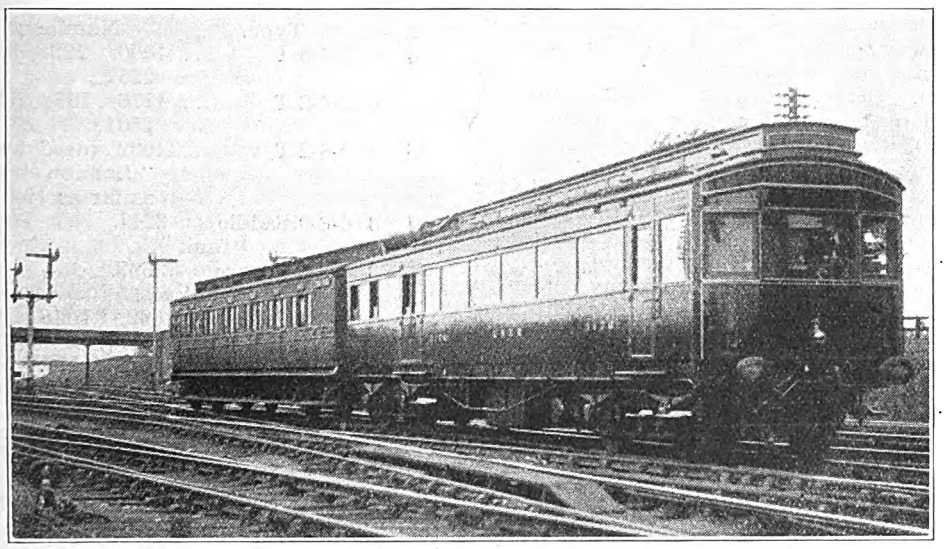

Photo.] [*Henry L. Salmon.*

AN EXPERIMENTAL PETROL-ELECTRIC COACH AND TRAILER.

On trial between York and Harrogate.

performance of the Nord-Sud, which passes under the river near the Place de la Concorde at no great depth from the bottom and has suffered interruption in former floods, gave special satisfaction and proved the efficiency of measures recently taken to resist flooding.

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THE Minister of Transport has recently made the following Order: The Babbacombe Cliff Light Railway Order, 1923, authorising the construction of a light railway in the borough of Torquay in the County of Devon.

* * *

To still further accelerate the booking of passengers on the London Underground Railway, change-giving machines have been installed at Liverpool Street, Earl's Court, Brent, Hendon, Victoria and Paddington. These new machines—coupled with the automaticket and rolltic machines, of which there are now 73 on the system—make the process of issuing tickets and supplying change a very rapid and yet simple matter. If, say, half-a-crown is tendered for a 2d. ticket, the pressing of one button of the automaticket machine delivers the ticket in a flash immediately to the passenger's hand. At the same time the half-crown has been inserted into the change-giving machine and the pressing of two keys causes it to eject 2s. 4d. Recent tests have shown that the whole operation of supplying a passenger with ticket and change occupies only 4 sec. This speeding-up machinery has proved invaluable at congested points during busy traffic, as no less than 900 passengers can be booked by each machine in the hour as against 660 without the new time-saving machinery.

* * *

FOR many years past the calendars issued by the companies associated with the Underground Electric Railways Company of London Ltd., have attained a very high standard of artistic merit. That for 1924 consists of 12 cards fitted within a frame casing, so that each month can be brought to the front as required, those which have

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served their purpose as calendars being preserved behind. Each of these cards bears a portrait of a historic personage, together with a crest or other device, and, at the foot, some biographical particulars. The portraits are in colour, and the production is of a very high standard. The subjects are: *January*, Sir Christopher Wren; *February*, John Colet, founder of St. Paul's School; *March*, Sir Thomas Gresham; *April*, Sir Hugh Myddleton, constructor of the New River; *May*, the first Earl of Craven; *June*, Nell Gwyn; *July*, William Caxton; *August*, Sir Hans Sloane; *September*, William Hogarth; *October*, Elizabeth Fry; *November*, Charles Dickens; *December*, Florence Nightingale.

* * *

Of the best of modern improvements to railway service in Canada are the Canadian Pacific combination dining and parlour cars. The new all-steel cars, six in number, will operate on the more important short runs, affording every convenience and luxury, where full size dining and parlour cars are not required. They are the only café parlour cars existent which are fitted with a smoking-room, and the revolving slumber-back chairs are another distinctive feature. The new cars are different from any others in Canada, in that they are divided into four separate compartments — kitchen, dining-room, parlour and smoking-room. In the vestibule between the kitchen and the dining car is a small "bar" capable of holding a remarkable number of bottles.

* * *

Mr. E. J. Nicholls, of Reigate, remarks that Southern Railway (S.E. & C. Section) locomotive No. 685, referred to in January, is a 0-6-0 saddle tank locomotive, and suggests that No. 686 is the engine which should have been mentioned. He also refers to several other locomotives bearing the word "Southern" over the number, with a letter indicating the section to which the engine belongs. Further, he comments upon the good work performed by Maunsell 2-6-0 locomotives on Redhill branch trains, several being used for trains working via Redhill. He also states that one of the Stirling 4-4-0 locomotives of the "458" class, concerning which a number of readers have written at various times, is stationed at Tonbridge and still retains its domeless boiler.

* * *

In reference to the services and the locomotives of the Wirral section of the L.M.S. Railway, Mr. Jeffry L. Bell writes from West Kirby as follows:—

The passenger service is run mainly by the 0-6-2 and 2-4-2 North Western tank engines, the old Wirral and the 2-4-0 locomotives being used mainly for goods and shunting work. The rolling stock consists of four six-coach electric-lighted steam-heated sets, lettered "Wirral Section No. 1 (2, 3 or 4)" over the buffer beams; one four-coach similar set, in L.N.W.R. livery; three L.Y.R. five-coach sets, and various L.N.W. and L.Y.R. six-wheelers for making up. Two signals have been replaced by North Western types. Below is a list of locomotives:—

Old Wirral engines—

No.	Type.
9	0-4-4 T
10	0-4-4 T
14	4-4-4 T
15	4-4-4 T

L.N.W.R. engines—

ft.	in.	Type.	Numbers.
4	0	2-4-0 T ..	1000, 2238, 2247, 2252.
4	6	2-4-2 T ..	1176, 1358, 2069, 2501.
5	0	0-6-2 T ..	1032 (used for the "London" train as far as Hooton).
4	3	0-6-0 Saddle Tank	3211.
4	3	0-6-0 Square Tank	3693.
4	3	0-6-2 Coal Side Tank	692, 1046, 1207, 2479, 2481, 7706 (late L.N.W. 3423).

* * *

Mr. J. W. Wood writes from Southend-on-Sea that the late Great Eastern Railway 2-4-0 mixed-traffic tender engine No. 427, working on the Southend branch, still bears traces of the old Great Eastern blue livery, including the red lining. Mr. J. Whitehouse also refers to this class, which he describes as "favourites of his, as they are of many other people." Most of them are now employed on country branches, though several work to or are stationed in London. Both these engines and the T 19 class of rebuilt 4-4-0's are to be found on branch lines in all parts of the Great Eastern system. The mixed-traffic engines, which number about 100, are being painted black, as they have small coupled wheels, while the T 19 class take the "express" green livery.

* * *

Pleasure parties are to be catered for on an unprecedented scale by the Great Western Railway during the present year, and a special department of the company's organisation will deal with the applications for those exceptional facilities. First and third-class tickets at reduced fares to places of local

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interest will be issued at all stations to pleasure and sports parties of, or equivalent to, not less than 12 adult passengers.

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THE successful experiment of placing "banks" of ticket machines in the circulating area at Victoria (Underground) station, as auxiliaries to the usual booking facilities, has led to the necessity for installing a change-giving booth in this area. This has been placed alongside the two aisles of ticket machines near to the subway connecting with the main line stations, with an attendant in charge to give change and assist passengers in the new method of booking. There are 12 machines in all and they are now dealing with approximately a third of the total bookings at Victoria Station.

* * *

ON January 1 a collection took place at all railway stations in Great Britain on behalf of the casualty and general funds of the Railway Benevolent Institution. The number of railway employees who became members of the casualty fund last year was 192,783, and assistance was rendered to no fewer than 96 widows of men killed, 613 widows of men dying from illness, and 4,703 men accidentally injured, being a total increase of 634 cases compared with 1922.

* * *

RECENTLY the Southern Railway issued an official notice headed "Railways Act, 1921," and reading as follows: "Notice is hereby given that all tickets which may be issued by the Southern Railway bearing the name of any railway company which has been absorbed or amalgamated in pursuance of the provisions of the Railways Act, 1921, shall be read and have effect as if such tickets bore the words Southern Railway."

* * *

ON and from February 1, season tickets generally will be issued on demand at applicants' residential stations on the South Eastern & Chatham section of the Southern Railway. This arrangement terminates the practice of all applications being made through the season ticket office at Cannon Street station. In order, however, to avoid congestion at the booking offices and to facilitate the issue, passengers are requested to give prior notice (24 hours if possible) of their requirements. Forms can be obtained at the stations for this purpose.

* * *

WHAT the railway has done in opening up the African continent was told by Mr. Robert Williams at a meeting of the Royal Colonial Institute on January 8. It was a story of Mr. Williams' work more particularly associated with the Benguella Railway and the line running between the Cape and Cairo. As he remarked in the course of his address, "the Benguella line will soon be through," but whether he live or not to witness the completion of the Cape to Cairo Railway—his greatest task—he knows that his work will not stop, that too much pioneering effort, too much of real value has been achieved for its progress now to be stayed. Only the discovery of "another mineral field" is wanted to complete the northern gap in the Cape-Cairo line, and Mr. Williams hints, in that connection, that "once again something new appears to be coming out of Africa." Already, he tells us, the Belgians are working out some rich gold mines at Kilo and Moto, near the Sudan frontier, and a motor road to these mines is already in existence. The future Cape to Cairo Railway may possibly follow that road. From the frontier the course would then lie over the great watershed, between the Congo and the Nile basins. That is a big gap, and unless minerals are found on the way in sufficient abundance to render it worth while to run a railway to them, it would seem almost hopeless to expect any Government, and still less any private enterprise, to bridge that gap. But there are "indications" that "another mineral milestone" will be found, and if this eventuates it will hasten the linking up of a complete arterial connection by rail from one end of Africa to the other.

* * *

APTLY described as "a paradise of wheels," the Model Engineering Exhibition held in the Royal Horticultural Hall, Westminster, January 4–11, inclusive, was a pronounced success. The hall was crowded daily with enthusiasts in model engineering and things mechanical, eagerly examining the wonderful models on view.

Broadly, the Exhibition was composed of three sections: (1) The production of individual effort, comprising mechanical, electrical and other scientific models and apparatus entered for competition, and a similar type of work, but not eligible for competition, in the Loan Section. Secondly, there was the Clubs Section—that is, the grouped collection of models by members of many of the well-known model engineering societies and power and sailing boat clubs of London and its suburbs. And, thirdly, there was the Trade Section. The most prominent exhibit in the latter was that of the well-known Northampton firm of model engineers, Messrs. Bassett-Lowke Ltd., while the stand of the Locomotive Publishing Co. Ltd. was invariably crowded with visitors.

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One of the most popular exhibits was a model 4-6-2 "Pacific" compound double expansion locomotive, which would carry on its trailer no fewer than nine persons. Built by a Mr. Crebbin, who is employed at the Bank of England, it was at once the envy and delight of a host of admirers. Although in model-making railways and locomotives take the premier position, there were plenty of other models for inspection, such as stationary engines, motor buses, traction engines, steamboats, warships and sailing-craft.

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A BATH correspondent writes: The re-introduction of the old standard colours of chocolate and cream for the Great Western Railway passenger rolling stock has been followed by the decision to revert to copper-capped chimneys and brass safety valve covers in the case of the locomotives. History of a little over 21 years ago is thus repeating itself on the Great Western Railway. It was in the 1899 to 1900 period that the plain cast-iron chimney was introduced on this line with the "Camel" type of 4–4–0 locomotive. Some two years later, in 1902, the copper-capped chimney was re-introduced with No. 100 (Now No. 2908) the pioneer of the 4–6–0 express type. Soon after the close of the war period the copper-capped chimney disappeared once more. Its reinstatement is now steadily proceeding.

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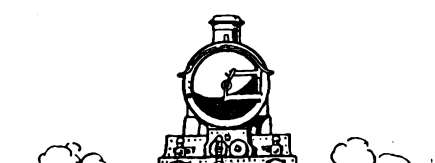
FROM Bromley, Kent, Mr. E. A. Gurney-Smith writes: All the most modern and heavy types of locomotives of the South Eastern and Chatham section of the Southern Railway have commenced to run via Bromley South, Shortlands and Beckenham to Charing Cross. On the 1.23 p.m. fast theatre train from Orpington (non-stop from Beckenham Junction to Charing Cross) I have travelled behind 0–6–4 tanks, No. 790, the heaviest type of 4–4–0 express engines and the latest "Moguls" with the new chimney. This train has become most popular, is very smartly timed and the few station stops at the beginning of the journey are worthy of those of a tube train!

* * *

ON Friday evening, January 11, the Railway Club welcomed one of its Vice-Presidents—Lord Monkswell—who read a paper of considerable value on "Compound Locomotives." As is well known Lord Monkswell has had intimate footplate experience of the working of compound locomotives, especially on the C. de F. du Nord of France, and it was clear from the outset of his paper that he is a master of his subject. After discussing the various factors which contribute to the low overall thermal efficiency of the steam locomotive—which does not exceed 7 per cent. in the best conditions—Lord Monkswell outlined the reasons which contribute to loss of efficiency, and discussed the three principal developments in locomotive design which aim at reducing efficiency losses, viz., feed-water heating, superheating and compounding. The different systems of locomotive compounding in use, with their characteristic features, were then dealt with at length, and illustrated by incidents from Lord Monkswell's footplate experiences, both here and abroad. In expressing appreciation of the valuable contribution made by the lecturer to the proceedings of the Club, the President, Mr. Cecil J. Allen, who occupied the Chair, describing himself also as a warm supporter of the compound principle, made some observations regarding the lack of success of compound working in this country, except on the Midland Railway, which he attributed to the inherent defects of certain of the chief systems tried. Questions were asked by a number of those present, to which Lord Monkswell replied, and a vote of thanks to the lecturer, proposed by Mr. W. Parker, a Past-President of the Club, expressed the hope that the members might look upon a visit from Lord Monkswell as an annual event.



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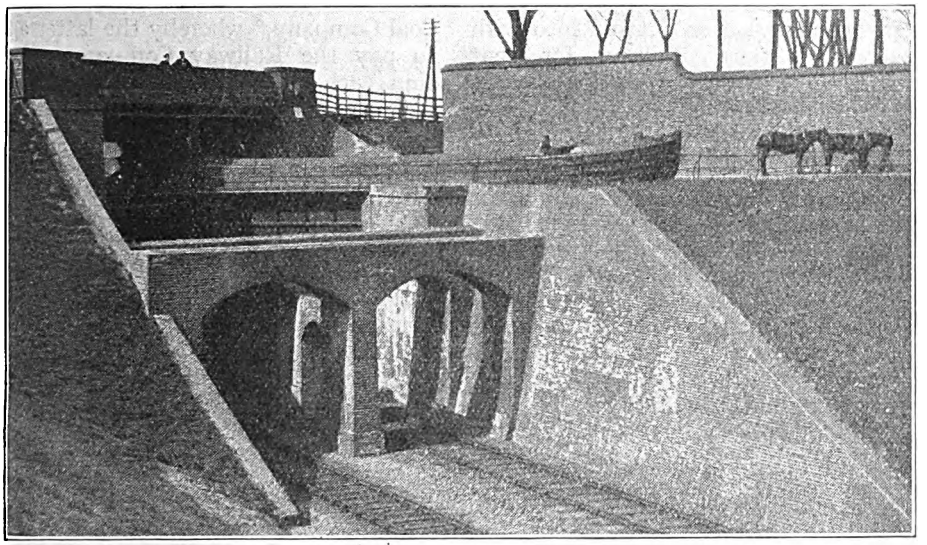

ROAD, CANAL AND RAIL ON THE BRENTFORD BRANCH.

The Brentford Branch, Great Western Railway.

By HAROLD L. HOPWOOD.

NOMINALLY the capital of Middlesex, Brentford has a history dating back some hundreds of years. The Brentford of to-day, however, with its long and narrow High Street, notorious for extreme congestion of traffic, is at best a dingy place, having as its principal industries the manufacture of gas and beer. From the commercial standpoint the town is favourably located, for in addition to being served by two railways—the Southern and the Great Western—it is situate at the junction of the River Brent and Grand Junction Canal with the Thames. Brentford is also the proud possessor of docks. This statement must not be taken too literally: the docks are certainly at Brentford, but their ownership is in the hands of the Great Western Railway, and it is this Company's branch line, extending from the said docks to the main line at Southall, which will be considered in this article.

Although within the London area, this section of the Great Western Railway is none too well known to the majority, probably owing to the fact that it has no direct connection with Paddington, the junction at Southall facing west. As a matter of fact, there is no actual junction with the main line; access thereto being obtained only through sidings. A journey from Paddington involves travelling west to Southall and then in a south-easterly direction to Brentford, a total distance of 12½ miles; whereas, by the shorter route, from Waterloo to the Southern Railway station at Brentford, the distance is 10¾ miles. Neither route, however, is particularly direct.

The branch was originally promoted by an independent Company, called the Great Western and Brentford Railway, for the purpose of constructing a line from the Great Western Railway at Southall to Brentford; also docks at the latter place. The Company received its Act of Incorporation on August 14, 1855, and at the first meeting, held at Brentford on December 6 in that year, the Chairman, Viscount Villiers of Banbury, stated that

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an agreement had been entered into with the Great Western Railway for that Company to work the line. This agreement, confirmed by Act of 1859, sanctioned a lease of the Brentford Railway and the docks to the Great Western Railway from the date of opening; the latter Company to pay to the Brentford Company a tollage on all traffic hauled. The estimated revenue was £15,200 per annum, of which £700 was expected to be derived from passenger traffic, and the remainder from 180,000 tons of coal and general merchandise.

In a report issued in 1856, and reviewing the future prospects of the Company, attention was called to the additional traffic in coal and other minerals from North Wales which would pass over the Great Western Railway in consequence of the new arrangement made by that Company. This, and the large increase of general traffic over the same railway, indicated most satisfactory prospects for the Brentford Railway, whilst the Thames Steam Tug Company, lately formed, would afford the necessary facilities for discharging that traffic on the river. The "new arrangement," alluded to above, was an agreement made between the Great Western Railway and the Ruabon Coal Company,* whereby the latter agreed to pay the Railway Company a stated sum each year for the carriage of coal over distances exceeding 100 miles.

The Brentford Railway was opened for goods traffic on July 18, 1859, and for passengers on May 1, 1860. Then a single line, it was, like the Great Western of that day, laid out on the broad gauge. The railway was only four miles in length, and from the first it was realised that amalgamation with the Great Western Railway would be inevitable. Acts of 1865 and 1871 sanctioned transfer to the larger Company, and the absorption took place in 1872. During its period of independence, the Company had enjoyed prosperity in a modest way, but, needless to say, the amount of traffic actually handled each year was only about two-thirds of that originally estimated. Since 1872, the principal event to be recorded is the conversion of the railway from a single line of broad-gauge to a double line of standard gauge, which occurred in 1875.

Photo.] **BRENTFORD STATION.** [*H. L. Hopwood.*

Looking towards the Docks.

* Described as "a model Company established among the officials for the purpose of showing the rate and manner at which the coal traffic of North Wales may be worked by the Great Western Railway."

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In May, 1904, the train which had hitherto worked the branch was superseded by a rail motor. Up to this time there had been no intermediate station on the branch, but a halt, 1½ miles from Southall—and known as "Trumper's Crossing, for Osterley Park"—was opened when the rail motor commenced to run. Later on, this car, which was a self-contained vehicle, was replaced by an "auto-car" train, *i.e.*, an engine coupled to one or more trailers and capable of being driven from either end.

In the summer of 1913 a half-hourly service was given in either direction on weekdays and Sundays. Trains continued to run for some six months after war was declared, but on March 22, 1915, the branch was entirely closed for passenger traffic. In this condition it remained for a little over five years, being reopened on April 12, 1920, with a service practically 50 per cent. less than that of pre-war days, *i.e.*, trains at approximately hourly intervals (except in the early morning and evening, when they ran every half hour) on weekdays only. A reduced Sunday service was restored in the summer of 1923; trains running every half-hour during the afternoon and evening, but they did not continue after the end of September. A considerable number of workmen use the line, but during the greater part of the day ordinary passenger traffic is light. The principal revenue is derived from coal and goods traffic conveyed to and from Brentford docks, there being five booked goods trains each way daily, besides specials which run in accordance with the requirements of traffic.

At Southall, branch trains run to and from the south side of the down main (island) platform. Once clear of the station, the line traverses open country until Brentford is approached, and for most of the way it is in close proximity to the river Brent, which, hereabouts, is joined by the Grand Junction Canal. For the most part, the line has a falling tendency towards Brentford; the steepest gradients being 1 in 102, 110 and 120. About one mile from Southall both the Grand Junction Canal and the road (Windmill Lane) are carried across the railway at the same spot, but at different levels; this curious example of engineering work being illustrated in one of the accompanying photographs. Half-a-mile further is Trumper's Crossing Halt. Approaching Brentford, the railway is carried by a fine lattice girder bridge across the new Great West Road, now in course of construction. Brentford station has the usual two platforms, but that on the up side is disused and all passenger trains use the down platform. The line

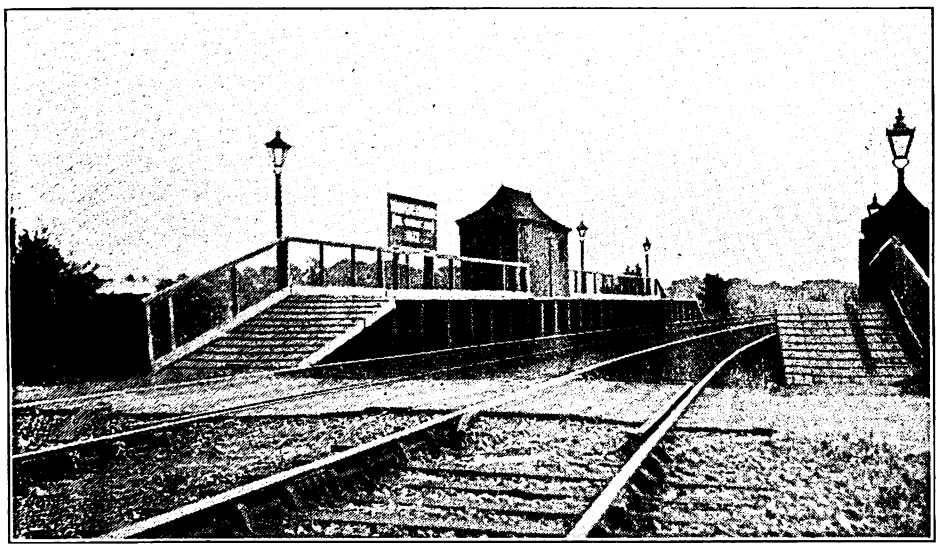

Photo.] TRUMPER'S CROSSING HALT. [*H. L. Hopwood.*

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continues past the passenger station for a further half-mile to the riverside, where the accommodation for dealing with shipping traffic is on an extensive scale, the total length of the quay being 2,270 ft.

It was at Brentford docks that the first concrete-built goods shed and warehouse was erected by a British railway company, and in view of the present-day extended use of concrete for railway constructional purposes, it is interesting to know that the Great Western Railway built this warehouse so long ago as 1899.

Distances, measured from Southall, are as follow :—

	Miles.	Chains.
Trumper's Crossing ..	1	39
Brentford Passenger ..	3	31
Brentford Docks	3	77

A CHARACTERISTIC WELSH RAILWAY POSTER.

SNOWDON MOUNTAIN
AND
WELSH HIGHLAND RAILWAYS.
its peaks lakes and passes its ancient story & picturesque costumes, affords endless delight to the
for illustrated holiday book to Manager Snowdon Railway Harlech

IT is but seldom that the smaller railways issue pictorial posters, but that reproduced, introduced jointly by the Snowdon Mountain and Welsh Highland Railways, possesses special interest, in that it combines the characteristic features of "Snowdonia, its peaks, lakes and passes," and directs attention to the ancient costumes of the people, the castles and other features peculiar to Wales. The original is in colours, and the contrasts inevitable to reproduction in black and white are then less severe and the effect pleasing in every way.

For further particulars of the new Welsh Highland Railway, readers are referred to the December number of the RAILWAY MAGAZINE.

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Locomotive and Train Working in the latter part of the 19th Century.

SOMERSET AND DORSET JOINT RAILWAY [No. II.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

WHEN Mr. S. W. Johnson took chief charge of the locomotive department, he decided to employ tank engines instead of tender engines for the main line passenger traffic between Bath and Wimborne (subsequently to Bournemouth). These engines, Nos. 10 to 14 and 29 to 32, were of the standard Midland 0–4–4 type, and were built in 1877 by the Avonside Engine Co. Ltd., of Bristol. The cylinders were 17 in. by 24 in., and the leading coupled wheels had a diameter of 5 ft. 3 in. One unusual feature in their design was that they were unprovided with cabs, but had merely rounded weatherboards both in front and at the back of the footplate In this respect they were somewhat similar to the first Midland tank engines, No. 6 class, of 1875, which worked in the London area through the Metropolitan tunnels. In the latter case the absence of cabs was in accordance with the regular practice in the Metropolitan area, and Mr. Johnson's Great Eastern tank engines, 15 of which had also been built by The Avonside Company, were similar. One of the latter was illustrated on page 154 of the RAILWAY MAGAZINE for September, 1918, and the Somerset and Dorset engines were almost exactly like them. But why cabless engines were supplied for the open country line of the Somerset and Dorset has always been beyond my comprehension, more especially as the Midland tank engines by Neilson & Co., 1875–6, were provided with the standard Midland cabs. A few years afterwards the Somerset and Dorset tank engines of 1877 were fitted with makeshift cabs by means of a sheet iron covering connected to the front and back weatherboards, for in 1880 the engines had to work two expresses in each direction between Bath and Wimborne. The next lot of four tank engines of the same class, Nos. 52 to 55, built in 1884 by The Vulcan Foundry Ltd., had cabs of the standard pattern.

It may be added that the thirteen 0-4-4 tank engines mentioned worked the whole of the main line traffic, including the expresses, from Bath to Wimborne, and afterwards to Bournemouth, until 1891 when the first 4–4–0 tender engines appeared. From 1878 the old 2–4–0 tender engines were relegated to the secondary services between Highbridge, Evercreech and Templecombe and during the period 1885 to 1891 I never saw one of them at either Bath or Bournemouth.

Mr. Johnson also designed a class of goods engine which remained the standard on the line from 1878 until 1896. These had 4 ft. 6 in. wheels, 17 in. by 24 in. cylinders, and 140 lb. pressure, and were similar in appearance, though different in dimensions, to the well-known Midland engines. The first lot of six engines was built by Messrs. Neilson & Co. in 1878, and these were followed between 1879 and 1890 by 20 similar engines built by The Vulcan Foundry Ltd. The wheel base of 15 ft. was 1 ft. 6 in. shorter than that of the Midland engines, and the heating surface of the earlier engines of the class was 1,105 sq. ft. Most of this class were stationed at Bath, but others were distributed between the principal main line stations. At Bath they replaced the older 19 to 24 class, which were transferred to Highbridge.

The first fast through service of trains was instituted in the summer of 1880, when the Midland began to run through carriages from Bradford and Newcastle to Bournemouth. There was one train in each direction from the far North, but another fast train each way had through coaches from and to Birmingham. The down train from Birmingham left Bath at 2.30 p.m. and reached Wimborne at 4.33 p.m., with three intermediate stops at

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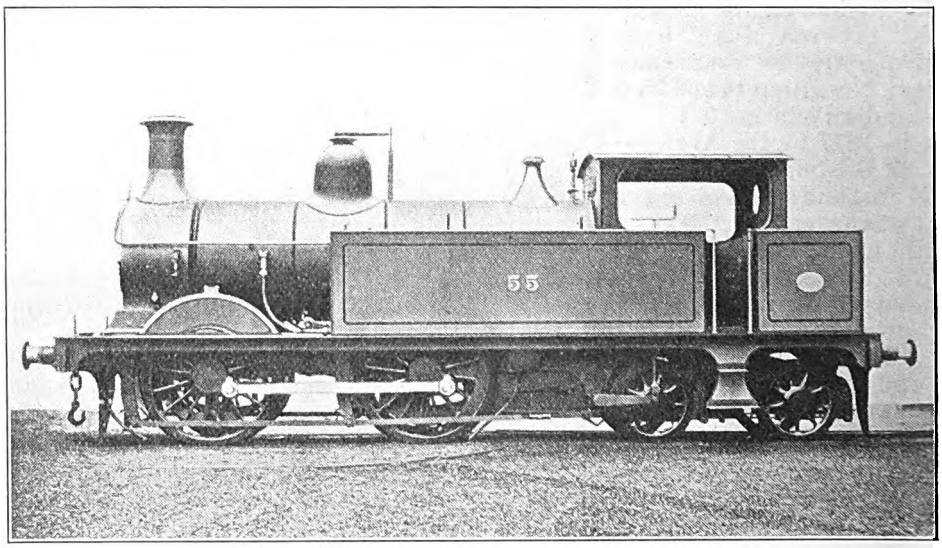
Shepton Mallet, Templecombe and Blandford. The 6.20 p.m. from Bath which formed the through train from Bradford and Newcastle was similarly timed. The distance is 64 miles, and when it is considered that the line was then "single" throughout, the "journey speed," including stops of 31¼ miles per hour, was excellent. The heavy gradients must also be taken into account, and undoubtedly the work was very hard for the 0–4–4 tank engines. There was in addition another fast down train, the 12.18 p.m. from Bath, which took 2½ hours for the journey, but this had several extra stops.

In 1888 the Midland attempted competition from the north to Plymouth, and a through carriage was run from Bradford. This was worked by the Somerset and Dorset Junction Railway between Bath and Templecombe (Upper station), where it was handed over to a London and South Western main line express. Through passenger traffic to Plymouth over this route proved, however, a failure, and after running for about 12 months or so the through carriage was abandoned.

The present colour of the locomotives is dark blue, not unlike that of the former Great Eastern. The original Somerset and



0-4-4 TANK ENGINE No. 55.

Built by Vulcan Foundry Company, 1884.
Coupled wheels, 5 ft. 3 in. diam. Cylinders, 17 in. by 24 in.

But the up Bradford express, which left Wimborne at 11.50 a.m., was still better as regards the "journey speed" of two hours to Bath at 32 m.p.h. This train, however, had only two stops at Blandford and Shepton Mallet, and gave Templecombe the cold shoulder. The run of 31 miles from Blandford to Shepton Mallet was done in 54 minutes. The best performance from a locomotive point of view was the run from Shepton Mallet to Bath, 21¾ miles of single line, much of which was over steep gradients of 1 in 50 to 1 in 80, which occupied 43 minutes, at an average speed of over 30⅓ miles per hour.

Dorset engines were dark green, which was superseded by the standard light green of the Midland, when the latter company took over the supervision of the rolling stock. When the Midland in 1883 changed the colour of its engines to red, the Somerset and Dorset Junction Railway locomotives followed suit, and this was the standard colour for many years until the present blue was adopted. Similarly the carriage stock after the lease was of a dark red colour of a shade very similar to that of the Midland. To-day the carriages are also painted dark blue.

In 1891 the first 4–4–0 tender express engines were put into service to supersede

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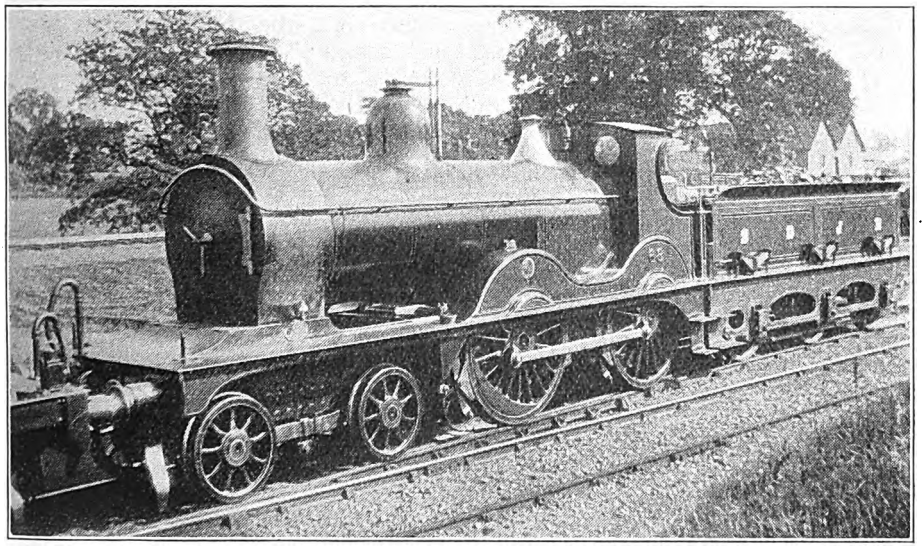
the tank engines on the fast main line trains. These engines, Nos. 15 to 18, were built by the Midland Railway at Derby, and have 5 ft. 9 in. coupled wheels with 18 in. by 24 in. cylinders, and 150 lb. pressure. The total heating surface was 1,202 sq. ft. The tenders of these and of the previously built goods engines were of a smaller and different pattern to those of the Midland, and carried 2,200 gallons of water. The springs were placed above instead of underneath the platforms. In addition to the four engines of 1891, two more of the same class, Nos. 67 and 68, were built at Derby in 1895, and were followed in 1896 by Nos. 14 and 45, making eight of the class altogether.



4-4-0 LOCOMOTIVE No. 68.

Built by Midland Railway, Derby.
Coupled wheels, 5 ft. 9 in. diam. Cylinders, 18 in. by 24 in.

In the meantime the main line had been diverted from Wimborne by the making of a new loop line about three miles in length from Bailey Gate to Broadstone Junction, so that the Somerset and Dorset fast trains could run direct to Bournemouth West without having to reverse at Wimborne. But the overall timing of the fast trains in 1891 was the same as in 1880, for the 2.25 p.m. from Bath took the same time, 1 hour 45 min. to Blandford, though it should be added that there was an extra stop at Evercreech Junction. The 5.45 p.m. north express from Bath ran to Broadstone in 2 hours 6 min. (63¾ miles) with four intermediate stops.

On the up journey the best train was the 9.40 a.m. north express from Bournemouth, which reached Bath at 11.50 a.m. The 31 miles run from Blandford to Shepton Mallet remained at 54 minutes as in 1880. A great improvement was made in the timing over the heavy section between Shepton Mallet and Bath (21¾ miles) which was booked to be covered in 35 minutes at an average speed of 37·3 m.p.h., by the second north express, which left Bournemouth at 1.30 p.m. From the time that the principal trains had been diverted to Broadstone Junction, Wimborne naturally lost much of its previous importance, and was served by three slow trains each way to and from Bournemouth, the engines of which had to reverse at Wimborne.

There were, however, in 1891 two additional fast trains each way over the "old main line," which ran between Templecombe and Bridgwater. One set of these made a connection at Templecombe (Lower station) with the Bournemouth expresses, and the other set were for the purpose of making London

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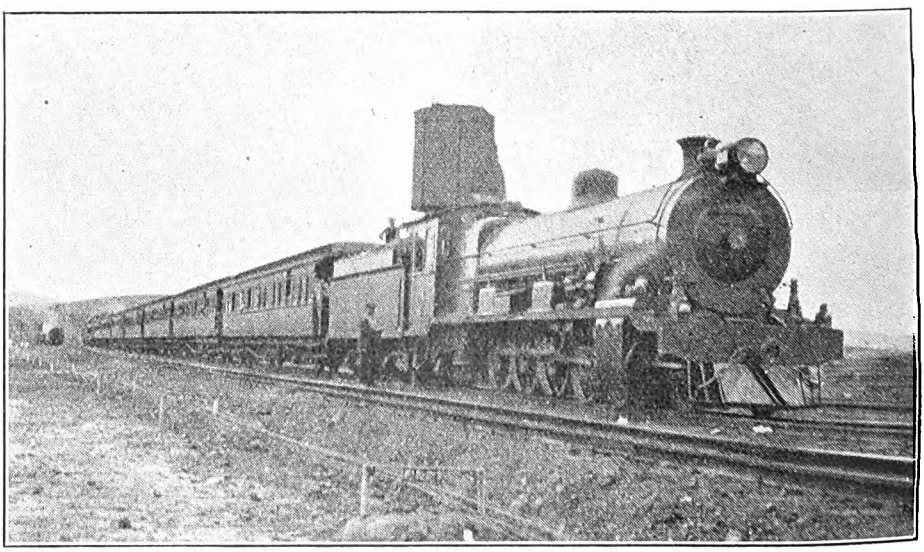
(Waterloo) connections at Templecombe (Upper station).

The Bridgwater section has not hitherto been mentioned, and had only been opened a short time. It is seven miles long, and branches from from the old line between Glastonbury and Highbridge at Edington Junction. After its opening the main section of the western line ran from Evercreech Junction to Bridgwater, and the original piece of the main line between Edington Junction and Burnham was relegated to the position of a secondary branch line.

The only other engines which the company added to its stock before the close of the 19th century were five goods engines of Midland standard design, having 5 ft. 2½ in. wheels, 18 in. by 26 in. cylinders, and 150 lb. pressure. These were built at Derby in 1896, and were much larger than the previous goods engines on the line. The tenders carried 2,950 gallons of water. They were put to work on the main-line goods trains from Bath.

By the end of the century the timing of the best down expresses from Bath to Bournemouth had been cut down from 2 hours 15 min. to 2 hours 10 min., with seven intermediate stops, four of which were at London and South Western stations from Broadstone Junction. The line had been doubled for much of the distance between Bath and Templecombe, so that it may be said that the locomotive work had in this respect become more easy than it had been in 1880, when the whole line was single and slacks were necessary at crossing places. On the other hand, the through north expresses now consisted of very heavy Midland bogie stock, and the longer trains probably weighed nearly three times as much as they had formerly done.

CHRISTMAS DAY IN SOUTH AFRICA.



In view of the suggestion made in the April, 1923, number that railway scenes on Christmas Day in various colonies would be of interest to readers, Mr. W. R. Bridger, of Durban, Natal, sends the photograph reproduced above showing the Durban-Johannesburg corridor restaurant car express taking water at Cliffdale, Natal, on December 25, 1923. Unfortunately, though conditions were anything *but* "wintery," as understood in England, the light was bad and rain was falling.

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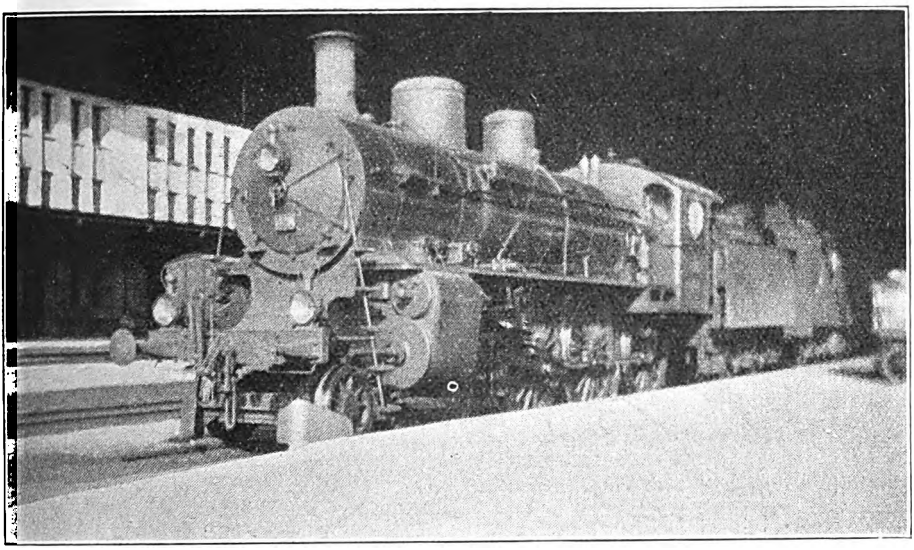

SWISS FEDERAL RAILWAYS.

4-6-0 locomotive, No. 616, at Lausanne.

Observations on Swiss Railways.

By JAMES I. PEARSE.

TO the railway enthusiast Switzerland offers a very varied field for his activities and interests. The area of Switzerland is about 16,000 square miles (not quite three times that of Yorkshire), and when it is remembered what a large portion of the area is mountainous and without any mineral wealth, it will be seen that with its 3,300 miles of railway the country is well provided with communications.

Swiss Railways may be classified in three groups: (*a*) The standard gauge lines, which absorb by far the greater portion of the mileage and are largely State-owned; (*b*) the narrow-gauge mountain lines, either rack or simple adhesion; and (*c*) the very steep funicular lines worked by cable. These last are necessarily short, but they are nevertheless very interesting and their construction has usually entailed notable feats of engineering.

In the case of the standard gauge lines, one cannot but be impressed by the amount of electrification that has been done, and is now being extended as rapidly as possible. One of the pioneers of electric traction for standard-gauge lines in Switzerland was the Berne-Loetschberg-Simplon Railway, which runs from Berne through Thun and Spiez and the Loetschberg Tunnel to Brig, where connection is made with the Simplon Railway, a total distance of 72 miles. There are also branches from Spiez to Interlaken and Bonigen (17 miles), and to Zweisimmen (17 miles). These formed the original railway. This line gives the principal approach to the famous and popular resort of Interlaken, where connection is made with the Bernese-Oberland Railway and with the Federal line to Lucerne. From Berne to Spiez the line is double, but beyond Spiez all three routes have one track only.

The present main line of the Berne-Loetschberg-Simplon Railway was the outcome of the opening of the Simplon Tunnel in 1906, and by means of its connection with the latter line at Brig has considerably shortened the distance from Berne to north-west Italy. The principal engineering feat is, of course,

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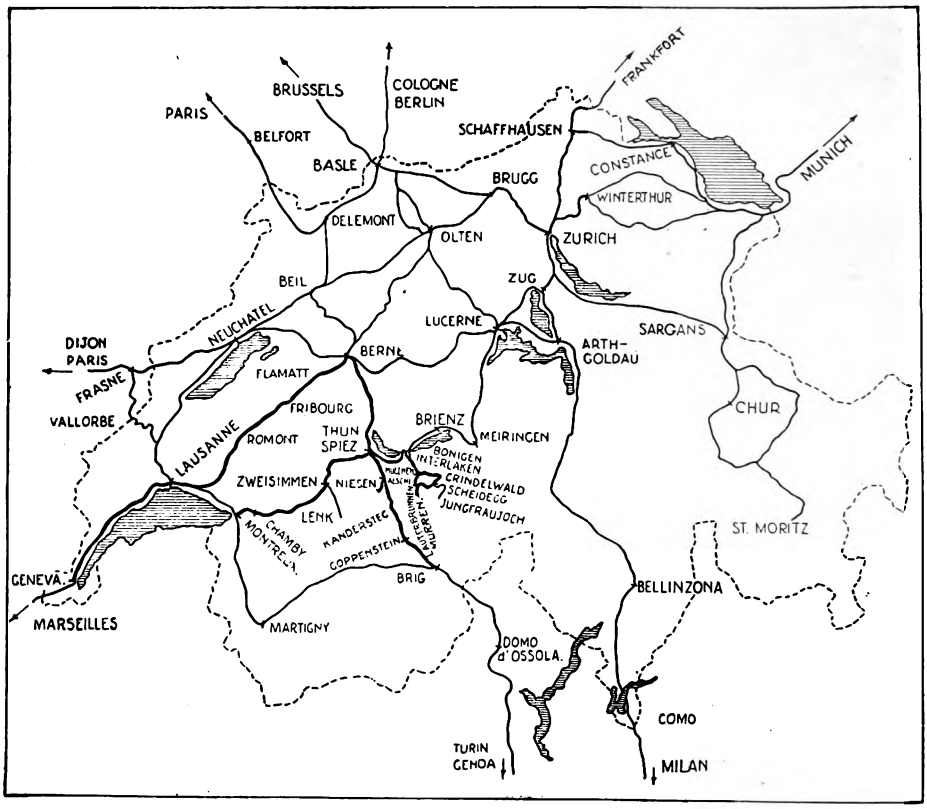

SKETCH MAP OF SWITZERLAND SHOWING PRINCIPAL RAILWAYS.

Lines which receive attention in the article are shown in thick lines.

the famous Loetschberg Tunnel and the approaches thereto. Situated between the stations of Kandersteg and Goppenstein, the tunnel has a length of 13,400 yards (roughly 7½ miles), and its altitude is about 3,700 ft. above sea level. Since its opening in 1910 the main line has been electrically operated with such excellent results that the branches have since been similarly dealt with.

The advantage of this method of traction was very strongly emphasised during the late war. There are no coal deposits in Switzerland, and all coal needed for locomotives and factories has to be imported. Prior to the war the principal source was Germany, but when these supplies were cut off the railways were forced to burn wood after their stocks of coal were exhausted. The results were naturally far from satisfactory, and it was not unknown for trains to have to wait while steam was being raised. During this period considerable portions of line were consequently electrified, and the scheme is now being pursued with great energy, in view of its great hydro-electric resources, so much so that it is said that within very few years the steam locomotive will be extinct in Switzerland.

The electric locomotives chiefly used for passenger traffic are of the 2–10–2 and 4–6–2 types, while on the Zweisimmen branch and elsewhere older 2–4–4–2 engines are in use. For local traffic a type of electric rail-motor is in use, which can be adapted to the needs of the traffic by attaching ordinary coaches as necessary. In July last a new station was opened at the old and prosperous town of Thun, which is a good example of modern Swiss station architecture. The chief feature is the spacious booking hall, whence access is given direct to the platforms. The exterior is very imposing, and the same can be said of many modern Swiss stations.

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As is the case all over Switzerland the station is quite open, tickets being examined and collected on the trains between stops. All coaches are therefore provided with gangways at each end to enable the collectors to pass along the train.

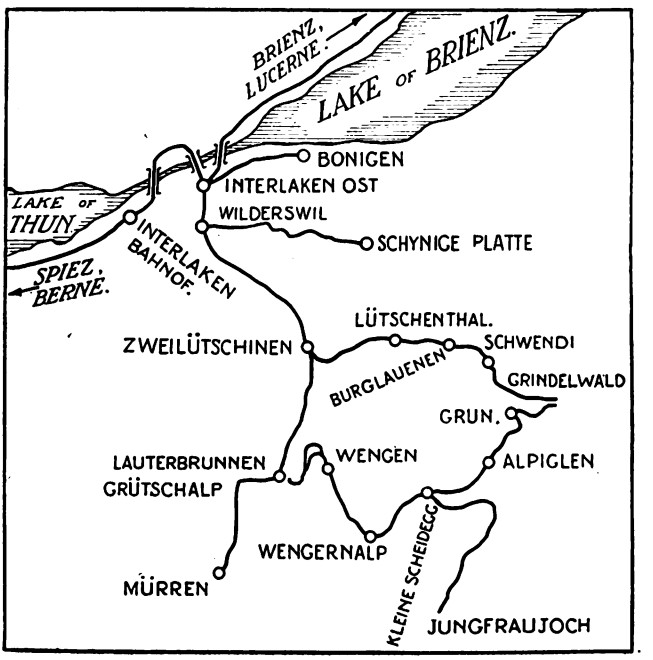
At Berne the Berne-Loetschberg-Simplon Railway connects with the Federal system, whose lines radiate to all parts of Switzerland. An interesting journey is that between Berne and Geneva, on which route there are several expresses daily, the quickest of which occupies 2 h. 55 min. for the journey of 99 miles. This time includes three stops, that at Lausanne being of 15 min. duration. Although trains are not generally heavy, this represents quite a good performance, since between Flamatt and Romont, 26 miles, the line is single, and high speeds cannot be attained on the long descent into Lausanne owing to the curves. The locomotives used are of the 4–6–0 type.

So far as signalling is concerned there are two chief types of signals in use corresponding to "distant" and "home." The former generally take the form of a circular green disc which faces the train when in the "danger" position and is turned edgeways to indicate "all right." The stop signals are frequently "upper-quadrant" signals, which assume a position 45 deg. above the horizontal when indicating "clear." They are semaphore arms constructed on a trellis-work principle.

In some of the geography textbooks of our schooldays, under the heading of "Industries of Switzerland," there appeared the entry "Catering for Tourists," almost at the head of the list. It is true that in many parts of Switzerland the population "lives" on the tourist, and it is only natural that amongst such magnificent and unique scenery everything should be done to attract visitors, on whom the natives are so dependent for livelihood. Thus it is that many mountain narrow-gauge railways have been built through districts where no one lives and where there is no mineral wealth, but where the scenery is so grand that the railway may be certain of filling its trains with sightseers during the summer seasons. Many of the higher lines are closed completely during the winter months, while others run on special occasions only, and still others do a good trade during the winter by catering for those who go to Switzerland for the winter sports. Under such circumstances, it is only to be expected that the fares are rather high, as the following examples will show (3rd-class single fares are given in each case) :—

Montreux–Zweisimmen, 39½ miles.—Fare approximately 10s. 5d.
Lauterbrunnen–Grindelwald, 12½ miles.—Fare approximately 10s. 4d.
Scheidegg–Jungfraujoch, 7 miles.—Fare approximately £1 3s. 4d.

Considerable reductions are given for a return journey. In spite of these fares, there can be very few who grudge paying them. The railways penetrate to the most beautiful and romantic parts of Switzerland, and by means of them the tourist can see and be amidst the finest scenery in comfort and with a minimum of trouble or effort.



SKETCH MAP OF INTERLAKEN AND JUNGFRAU DISTRICT.

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The first mountain railway journey undertaken by the writer was from Montreux, on Lake Geneva, to Thun, the gate of the Bernese Oberland. As far as Zweisimmen the journey is by the "Montreux-Oberland-Bernois" Railway, usually known as the "M.O.B.," where trains are changed and the journey continued by the Berne-Loetschberg-Simplon line before mentioned. The journey on the M.O.B. is one that cannot be forgotten, and the whole of its 39 miles is packed with interest both to the sightseer and to the railwayman. Built to the metre gauge, the line is operated by electricity picked up by the motors from overhead wires. The gradients are very severe, especially for the first half-hour out of Montreux, but are not steep enough to necessitate the use of a rack rail. The usual train consists of a motor-coach and 2nd-class compartment combined, weighing about 33 tons, and two or three bogie passenger coaches each weighing about 14 tons. The coaches are half open, enabling excellent views to be obtained. There is a non-stop train daily between Montreux and Zweisimmen (occupying 2 h. 33 min. for the journey of 39½ miles) to which a restaurant car is attached, which gives some idea of the enterprise displayed by the Company.

The Montreux terminus is alongside the Federal Railway station, where trains from Lausanne, Paris, and other parts of the Continent stop. The train immediately commences to rise, and after passing through a short tunnel runs on a ledge overlooking the town and lake. The mountains rise steeply behind the town, necessitating a very zigzag course being followed in order to get up, and some of the curves are exceedingly sharp, but are all negotiated without check rails. At Chamby, five miles from the start and 2,200 ft. above sea level, the view of the lake is perhaps best. Eleven hundred feet below is Montreux and the lake, one of the bluest in Switzerland. Straight across are the massive mountains of Savoy, and to the left the "Dents du Midi" and the Rhône Valley.

After Chamby the line turns inland, and after passing Les Avants a tunnel nearly 1½ miles long is entered. The sensation on entering this tunnel is very curious. Outside the heat is oppressive, but as soon as the tunnel is entered the temperature suddenly drops to 40 deg., and the ladies wish they had remembered their furs! The line is now more level, but speed is always restrained—the maximum is 30 m.p.h. The terminus at Zweisimmen is situated in a valley into which the train descends rapidly, the steepest part being through a horseshoe-shaped tunnel, and on emerging from this the new M.O.B. branch from Lenk is soon joined. At Zweisimmen the M.O.B. is reluctantly left behind and the journey continued by the standard gauge Berne-Loetschberg-Simplon Railway.

From Interlaken a magnificent circular day tour can be undertaken, embracing the Bernese Oberland Railway and the Wengernalp Railway, together with the Jungfrau Railway if desired. There are two stations at Interlaken, the metre gauge Bernese-Oberland Railway starting from the second or "Ost" station. The writer was greatly surprised on first seeing the train which was to convey him to Lauterbrunnen. One expected a mountain railway train to consist of two or three coaches at the most. Not so this railway—we left Interlaken with seventeen 4-wheeled coaches, necessitating the use of two electric locomotives, one of which was placed in front and the other at the rear. These are 6-coupled machines with very small driving wheels, and they are exceedingly powerful, since they are called upon to surmount gradients of 1 in 30 on pure adhesion and about 1 in 9 on the steepest rack portion.

Leaving Interlaken, the line curves round to the right and reaches Wilderswil, the junction for the Schynige-Platte rack railway, and then enters the valley of the Lütschine, and rises to Zweilütschinen, 5¼ miles from Interlaken, where the Grindelwald and Lauterbrunnen lines diverge. So far no rack rail had been necessary, but between Zweilütschinen and Lauterbrunnen there are two portions of track so equipped. At Zweilütschinen we left five coaches for Grindelwald and continued up the rack portion with 12, which seemed well within the capacity of our two engines. On the arrival of a train from Interlaken the small station at Lauterbrunnen presents a most animated appearance. On the left are the small coaches of the wonderful Wengernalp

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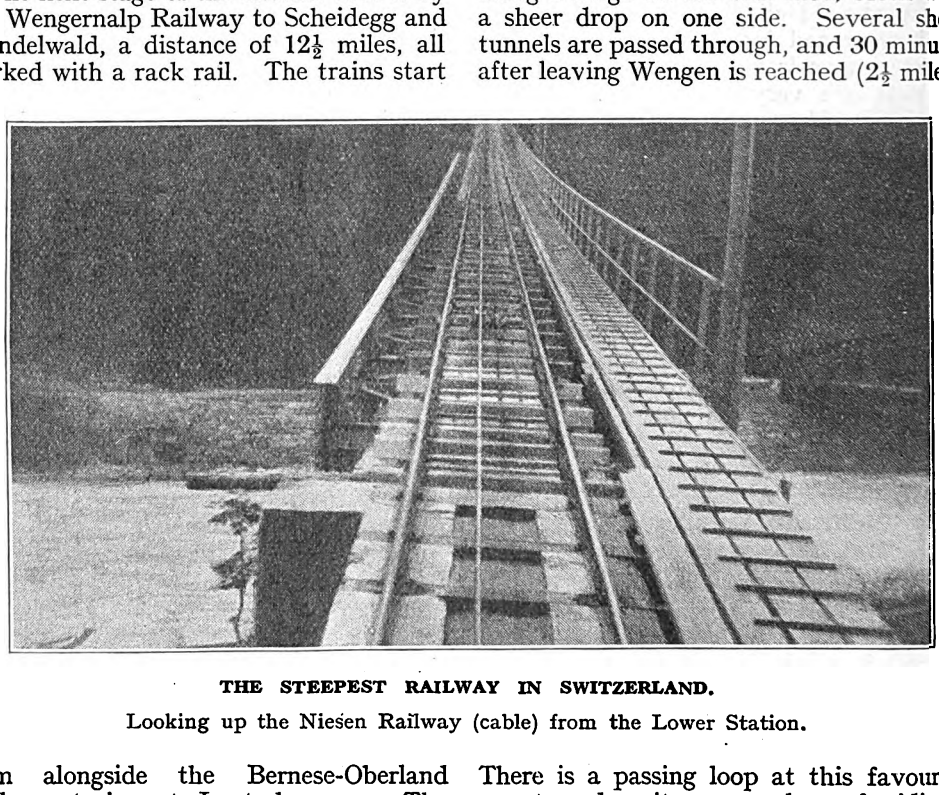
Railway, while on the right, just across the road, is the funicular line to Mürren. Many visitors spend a couple of hours or so at Lauterbrunnen before continuing their tour, a visit to the Trümmelbach falls being well worth while. The journey from Lauterbrunnen to Mürren is done in two stages. The first section is by cable railway up to Grütschalp, with a maximum gradient of about 1 in 2, and thence by electric train for the remaining 2½ miles.

The next stage of the circular tour is by the Wengernalp Railway to Scheidegg and Grindelwald, a distance of 12½ miles, all worked with a rack rail. The trains start from alongside the Bernese-Oberland Railway trains at Lauterbrunnen. The line is now worked by electricity, but originally steam locomotives were employed. These old locomotives could take only one coach over the steepest portion, whereas the present electric engines manage three with ease. The regulations governing the running of these railways are very stringent, especially in regard to speed. Neither uphill nor downhill, nor on the level, may trains exceed 9 kilometres per hour (about 5½ m.p.h.). If this speed is exceeded the brakes are automatically applied and the train stopped. The engine is always placed at the lower end of the train so as to be below the carriages. Thus the train is always pushed uphill, and there is no risk of couplings breaking and carriages running away.

On leaving Lauterbrunnen the line curves sharply to the left and immediately starts to climb the precipitous side of the valley. The line soon divides, and there are two routes from this point to Wengen. The "old" line is shorter but steeper, and trains nearly always use the "new" line which bears off to the left and climbs along a ledge on the cliff face, often with a sheer drop on one side. Several short tunnels are passed through, and 30 minutes after leaving Wengen is reached (2½ miles).



THE STEEPEST RAILWAY IN SWITZERLAND.

Looking up the Niesen Railway (cable) from the Lower Station.

There is a passing loop at this favourite resort and quite a number of sidings. Beyond Wengen the railway continues to climb, and after stopping at Wengernalp reaches Kleine Scheidegg, 6·9 miles from Lauterbrunnen. This is the junction for the famous Jungfrau Railway, the terminus of which, at Jungfraujoch, is the highest in Europe—11,480 ft. above sea-level.

In the 6·9 miles from Lauterbrunnen to Scheidegg the Wengernalp Railway has risen 4,160 ft., but from this point the line descends still more steeply to Grindelwald. In order to keep the engine at the lower end of the train it is necessary to

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change carriages at Scheidegg. The descent down to Grund is the steepest part of this railway, the first station Alpiglen, 2¼ miles from Scheidegg, being 1,500 ft. lower, while in the next 2·6 miles to Grund the line falls 2,100 ft. Grund is really Lower Grindelwald, and the train, after stopping at the station, is reversed and pushed up for half a mile to the main station at Grindelwald, alongside the Bernese-Oberland Railway.

From Grindelwald passengers return to Interlaken by the other branch of the Bernese-Oberland Railway, which leaves the Lauterbrunnen line at Zweilütschinen. The line is downhill all the way, with two sections of rack, the first three-quarters of a mile long, and the second one mile long, both with a gradient of 1 in 9. The circular trip thus completed represents a total distance of about 32 miles, occupying an actual running time of approximately 4½ hours. Of course it is expensive, a circular ticket costing 15s. 6d., but it is well worth doing.

There are many cable railways in Switzerland, one of the latest and most interesting being that up the Niesen, which was opened in the spring of 1910. The line starts from Mülenen-Aeschi on the main line of the Berne-Loetschberg-Simplon Railway and goes right up the side of the mountain to within a few feet of the summit. It is the steepest railway in Switzerland, its maximum gradient being 68 per cent. At the bottom one is 2,079 ft. above sea level—at the top 8,101 ft., and this difference of just over 6,000 ft. is surmounted in a little over two miles! The journey is performed in two stages, cars being changed at Schwandegg, which is about half-way. The lower section, after crossing the River Emd, ascends chiefly through woods, with one short tunnel and several viaducts. The upper half is steeper and has several long bridges and a tunnel. The bridges are built with a parapet on one side only, on the other side there is no protection. However, the carriage doors are locked before starting, so that there is no danger. The line is single with a passing place in the middle of each section, where ascending and descending cars pass. The journey, both going up and returning, occupies 45 min. From the summit a celebrated view is enjoyed on a clear day. To the north the town of Thun and the plain beyond form a striking contrast with the massive snow-capped mountains to the south.

In conclusion it may not be out of place to consider some Swiss Railway methods and compare them with English methods. In the first place electric traction may be briefly dealt with. It has already been suggested that in a few years the steam locomotive may no longer be in use in Switzerland, and the chief reason for this is that the country has an unlimited source of cheap electricity, whereas all coal burned must be imported. In England the conditions are reversed. We have an abundant supply of cheap coal, and we have not sufficient power in our rivers to generate enough electricity to run our railways were they all electrified. Hence fuel would still be necessary, and the saving in expense would not be so great as in Switzerland, where all their electricity can be generated without burning an ounce of coal. One aspect of the subject which is apt to be overlooked is the dependence of an electric railway on its power station.

At the present time, when there is so much discussion about high railway fares in this country, it may be interesting to examine those in operation on the Swiss Federal Railways. The long distance traveller is perhaps the one who feels the burden of a high railway fare most. In this country the full 2½d. per mile 1st class and 1½d. per mile 3rd class are charged over the whole distance, but in Switzerland the further one travels the less it costs per kilometre, as will be seen from the following table (for the sake of comparison with English railways francs have been converted into shillings and pence, reckoning a franc as equal to 10d.):—

Distance.		Classes.					
Kilos.	Miles.	1st.		2nd.		3rd.	
		s.	d.	s.	d.	s.	d.
2	1¼	0	3½	0	2½	0	1½
8	5	1	1½	0	9½	0	6
16	10	2	2½	1	6½	1	0
80	50	11	0	7	8	5	0
160	100	22	0	15	4	10	0
240	150	30	8	21	2	13	6
320	200	35	6	25	7	16	0
480	300	53	1	37	3	24	0

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It will be seen that while on a distance of 100 miles a passenger pays 2·64d., 1·84d., and 1·2d. for the three classes, at 200 miles these figures are reduced to 2·13d., 1·53d., and 0·96d. respectively, while beyond this distance no appreciable reduction is given, because there are very few journeys in Switzerland more than 300 miles in length. In the case of a journey of 300 miles these fares give a reduction of about 20 per cent. in each class. Applying this to an English example, say Paddington and Penzance (305 miles), where the 1st and 3rd-class single fares are 63s. 2d. and 37s. 11d. respectively, a 20 per cent. reduction would reduce these to 50s. 7d. and 30s. 4d. respectively, an appreciable saving. It would seem that this system offers considerable attractions to the long-distance traveller, but there are several other factors which must be taken into account before a reliable comparison can be made. In the first place these Swiss fares do not include any free luggage allowance, and all luggage carried in the van has to be paid for on a mileage basis. The following charges are for 100 kilogrammes (220 lbs.), but of course a proportionate amount is charged for lesser weights :—

Distance.		Charge per 100 kilos. (220 lb.).
Kilos.	Miles.	s. d.
50	31	5 2
100	62	9 9
200	124	16 8
400	248	24 6
700	435	35 7

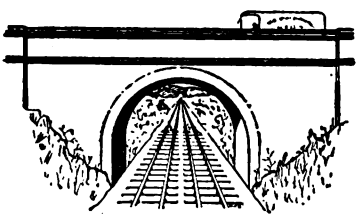
In the second place these fares that have been briefly analysed apply only to stopping trains and to a few of the slower and less important expresses. For the privilege of travelling in an express train supplements have to be paid which vary for each class :—

Distance.		Classes.		
Kilos.	Miles.	1st.	2nd.	3rd.
		s. d.	s. d.	s. d.
1–50	1–31	0 10	0 7½	0 5
51–100	32–62	1 8	1 3	0 10
101–150	63–93	2 6	1 10½	1 3
over 150	over 93	3 4	2 6	1 8

When taking these into consideration it will be found that the fares from London to Penzance would be as follows :—

	1st. s. d.	3rd. s. d.
Present fares less 20 per cent.	50 7	30 4
Supplements for luggage (150 lb. 1st class, 100 lb. 3rd class)	14 2	9 5
Supplement for express train	3 4	1 8
	68 1	41 5
Present fares ..	63 2	37 11

The traveller in Great Britain is not therefore so very badly treated after all, while the English 3rd-class accommodation is much superior to the Swiss, where wooden seats only are provided, even on expresses, and the journey would probably take considerably longer in Switzerland.



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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

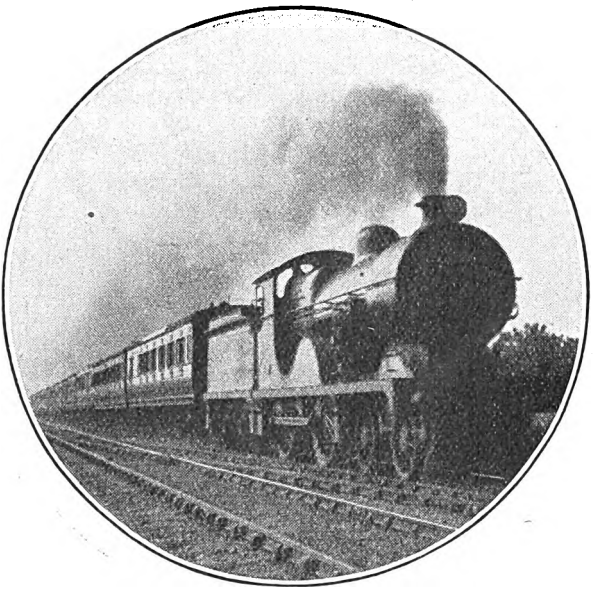

Photo.] [*E. A. Gurney-Smith.*

SOUTHERN RAILWAY.

Birkenhead–Deal Restaurant-car express passing Edenbridge. South Eastern and Chatham 4–4–0 locomotive, No. 773.

AS foreshadowed last month, it is my intention to take up the suggested designs for the express locomotives of the future which have figured in some thoughtful and highly interesting communications received recently from readers. The first of these correspondents—Mr. A. P. Ramiah—submits a rough sketch of a locomotive of the 4-4-0—2-6-2 type, and writes thus:—"A naïve paragraph in one of the daily papers not long ago, commenting on steam tenders, may have amused those of your readers who noticed it. The writer of the paragraph in question remarked that the chief reason against the adoption of the steam tender is the inability of designers to mount a boiler sufficiently large to provide an adequate quantity of steam to the four cylinders of the engine and tender. This, in the light of recent locomotive practice, hardly needs any comment, as witness the four-cylinder engines of the Great Western Railway, and the late Great Central, London and North Western, London and South Western, and other lines." At the same time it is possible that the writer of the paragraph concerned had in mind the provision of cylinders on the tender equal in size to those at present carried by a large modern two-cylinder engine, and supplied from the boiler of the latter.

"In these days of heavy express trains ranging from 400 tons upwards, the foremost problem facing designers appears to be the production of a locomotive that will afford the maximum of adhesion weight and boiler power with the minimum of rigidity. Mr. Gresley's Great Northern 4-6-2's seem practically to have reached the extreme limits of our loading gauge; their boilers, tapering in diameter from 5 ft. 9 in. out to 6 ft. 5 in., and with wide fireboxes mounted over 6 ft. 8 in. coupled wheels, seem to indicate that very few, if any, further developments can be expected along conventional lines of design. If the weight of express trains continues to increase, as it very probably will, and it is found desirable to increase the average end-to-end speed of those trains—to enable, say, the chief trains to be operated between London and Edinburgh in 7 or 7¼ hours, which would entail a throughout average of 54 to 56 m.p.h. or so—it would obviously be necessary to provide locomotives capable of maintaining high speeds, not only on the level and downhill, but on adverse

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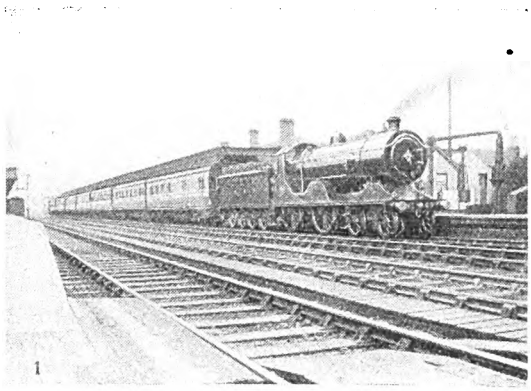
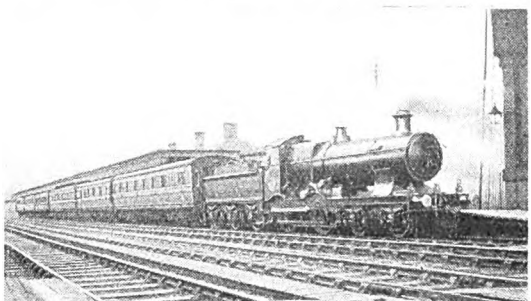
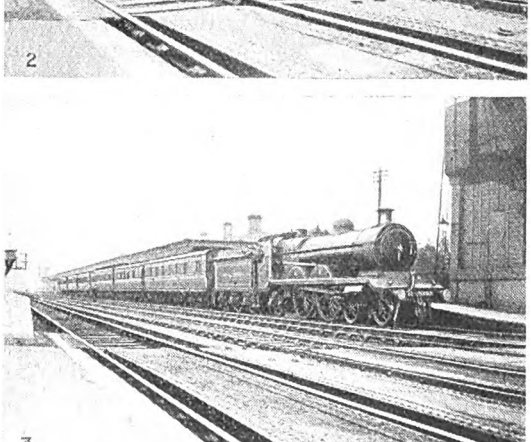
grades as well. The principal factors essential to performances of this character are greater boiler power and adhesion weight, rather than larger cylinders in conjunction with a very high working pressure.







Photos.] [*H. C. Doyne.*

ENGINE WORKING AT OXFORD.

Nos. 1 and 3 show the Manchester, Birkenhead and Bournemouth through train respectively with Southern (L. & S.W.) Railway 4-4-0 locomotive, No. 463, and L. & N.E. (Great Central) 4-4-2 engine, No. 1093. No. 2 shows the Newcastle, Bradford and Bournemouth through train, with Great Western 4-4-0, No. 3326, "Laira."

"Theoretically a locomotive on the lines suggested would seem to fill the bill, inasmuch as over 63 per cent. of the usually non-productive dead-weight of a loaded tender is utilised for adhesion. A boiler coned from a front end diameter of 6 ft. 4½ in. to a firebox-end diameter of 7 ft. 1½ in., with a wide firebox, should be capable of supplying four 17½ in. by 28 in. cylinders with all the steam they would require, while at the same time furnishing an ample reserve for uphill work. Owing to the great size of the boiler, which is designed to be flush with the cab roof at the firebox end, the locomotive is arranged to run tender first, the sides of the coal space being cut away to afford a clear look-out from the double cab, unhindered by the escaping exhaust. The Robinson system of burning pulverised fuel, superheating and feed-water heating are other suggested features of the equipment.

"To sum up, the design shows a 2-6-2 locomotive with a 4-4-0 tender, the whole forming a power-unit as flexible as any present-day locomotive, and yet affording 20 to 25 per cent. greater boiler power, and possessing an adhesion weight of 100 tons against the 60 tons of the London and North Eastern 4-6-2 engines. This, then, is virtually an articulated tank locomotive which does not share the obvious limitations of the Mallet and Garratt types, and since theoretically it seems to fulfil every condition necessary for safe working at high speeds, and carries the usual quantity of fuel and water that would be necessary for a non-stop run of, say, 200 miles, and, further, provides 35 to 40 per cent. greater actual tractive effort than does the most powerful British 4-6-2 in existence, the question which naturally would be raised by the layman is as to what insuperable mechanical and practical difficulties stand in the way of designing and running such a locomotive."

The writer then adds that he knows of no steam-tender locomotive since the

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Stirling engines of "some thirty years back," but in point of fact the engines concerned were introduced by Sturrock as far back as 1863. My correspondent then inquires as to the non-adoption of this type of engine on a wider scale. So far as the Sturrock engines are concerned, the answer is simply that the chief advantage obtained was in starting, the engine boilers of the period being inadequate in capacity to find steam continuously for two 12 in. by 17 in. cylinders, in addition to the 16 in. by 24 in. engine cylinders. Coal consumption and maintenance costs also reached high figures, while there are legends abroad to the effect that their drivers demanded scales of pay adequate to the fact that they were working two engines instead of one! In any case, an order for 70 of these tenders was countermanded well before they had all been constructed, and the tenders which had been so constructed were soon stripped of their propelling gear. It was the old, old story, I fear, of a locomotive engineer trying to secure a higher tractive effort by increased cylinder capacity, without commensurately increased power for the generation of steam, which generally implies increase of weight as well.

There is considerable ingenuity in the modern steam-tender locomotive design proposed by my correspondent. In certain respects, however, it has its weak points. First of all, he has divided up his cylinder volume equally into four cylinders, each 17½ in. diameter by 28 in. stroke, two operating the six-coupled driving wheels of the engine, and the other two the four-coupled driving wheels of the tender. That is to say, equal propelling power is to be transmitted to the rail through the medium of 60 tons adhesion weight on the engine, as is to be transmitted through 40 tons tender adhesion weight, and it is also to be remembered that the latter adhesion would be a constantly diminishing quantity as the supplies of coal and water were being used up *en route*. Personally, I should be inclined to favour a proportion of, say, two 20-in. by 26-in. engine cylinders to two 15-in. by 26-in. tender cylinders. As compared with the Gresley "Pacifics," on which the engine part of the design is clearly modelled, four sets of valve-gear would be required instead of two, which would tend, with the provision of tender driving gear generally, to increase of maintenance costs. In high-speed running it would be found that the lengthy journey of the steam from the dome to the tender cylinders and back to the chimney would be a distinct disadvantage, while the utilisation of the tender exhaust—in the design constituting one-half of the exhaust of the four cylinders—for feed-water heating would probably reduce in a serious degree the draught required to supply a firegrate having so large an area as 50 sq. ft.

To sum up, I am inclined to doubt whether the design would offer, when worked out in detail, any material advantage over the Gresley "Pacifics." To revert to the preliminary argument on which my correspondent has based his ideas, one may say (*a*) that there is very little likelihood of any increase of express trainloads above the maximum which these engines operate with ease, seeing that such a train as the 5.45 p.m. down Leeds is too long to be drawn up at all the intermediate stations on the Great Northern main line, with the sole exception of the Western platform at Doncaster. Then (*b*), in regard to speed, the extraordinary performances of these engines, as recorded more than once in these columns, leave no doubt as to their capacity for working to materially expedited running times, when expedition of services becomes necessary. And this acceleration could be obtained just as easily uphill as downhill, after such demonstrations as sustained 50 m.p.h. uphill speeds on 1 in 200 grades with loads of 455 and 475 tons behind the tender. Lastly (*c*), neither greater boiler power nor greater adhesion weight seem to be required, seeing that under the hardest conditions of present-day service the engines concerned never appear to be short of steam, and they very seldom suffer from slipping troubles, the even turning moment afforded by the three cylinder arrangement being doubtless of considerable value in the latter direction. For the present, therefore, the need for a locomotive type of greater boiler or adhesion capacity than the Gresley "Pacifics" must be considered as "not proven."

My second correspondent, Mr. John Poole, writes from the Argentine in

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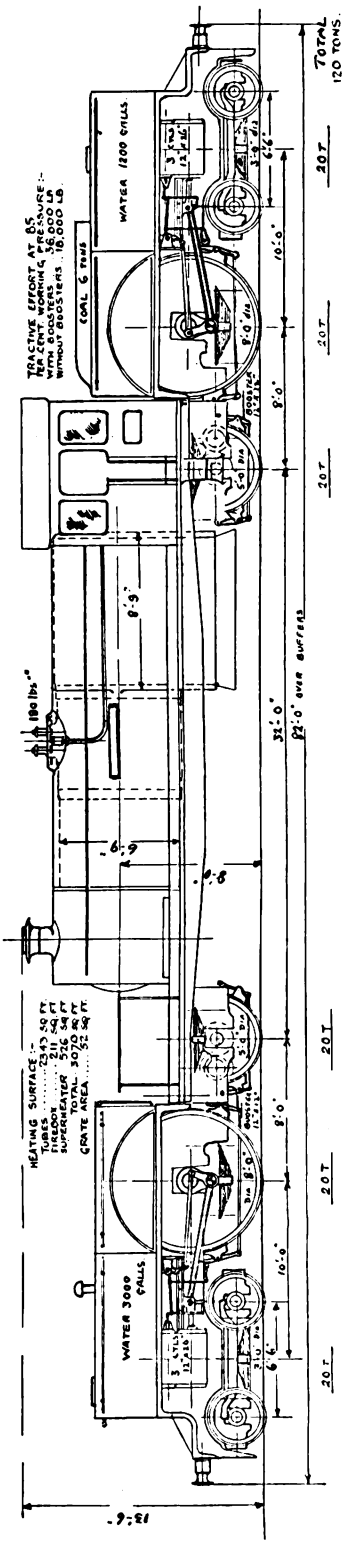

SUGGESTED SINGLE-DRIVER "GARRATT" EXPRESS LOCOMOTIVE DESIGN.

connection with recent remarks in these columns concerning the suggestion, advocated in the *Observer* newspaper, of a return to single-driver locomotives for express passenger service. His letter runs thus: "Although your arguments effectually dispose of the *Observer* correspondent, from some twenty years' experience of locomotive design, I am inclined to think that he has the germ of the right idea. Let us examine the requirements of a locomotive for running trains of 500 to 600 tons at an average speed of 60 m.p.h. These are (*a*) high tractive effort at starting; (*b*) low internal resistance at high speed; (*c*) boiler capacity to supply steam under maximum conditions of demand; and (*d*) a tractive effort which does not fall below zero at any less speed than 100 m.p.h. Now, comparing the single-wheeler with a six-coupled express locomotive, the former appears to satisfy requirements (*b*) and (*d*), while the latter fills requirements (*a*) and (*c*). The ideal express engine should, therefore, combine the high initial tractive effort and large boiler capacity of the six-coupled machine of moderate driving-wheel diameter, with the low internal resistance and therefore sustained tractive effort at high speeds of the single-wheeler.

"Now it appears to me that the only possible combination to meet these two extremes would be twin booster-fitted single-wheeler engines with the Garratt arrangement of slinging a large diameter boiler on a girder frame between the two driving units. The attached sketch"—reproduced herewith—"gives you my conception of such a machine. Each unit consists of a single-wheeler of the 4-2-2 type, with 8-ft. driving wheels, fitted with booster driving gear to its trailing wheels, which are designed as of 5-ft. diameter, so that the booster may work up to 50 m.p.h. without exceeding a rotating speed of 560 r.p.m. As regards the 8-ft. driving wheels, three cylinders are shown for the operation of each, on account of the superior crank effort curve and more perfect balance attained by this means, and, incidentally, for the light reciprocating parts thereby rendered possible. It will be noticed that all the cylinders, including the booster cylinders, are of the same diameter, and there is no reason why the three cylinders of each of the

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main engines should not be arranged at will on the Smith compound system, thus adding further to what is already an extremely flexible arrangement. In other respects the design speaks for itself, and to my mind the whole arrangement represents the only solution whereby the reciprocating steam engine can be made to meet the diametrically opposed conditions demanded by the working of heavy trains on hard roads at high speeds."

Here again we have an extremely ingenious conception. My most damaging criticism in this case is that an overall length of 82 ft.—11 ft. more than a Gresley "Pacific" with her tender—would, despite no necessity for turning, be practically certain to occasion trouble in the matter of side clearances within our restricted construction gauges, despite the flexibility of the Garratt wheel-base. Secondly, the provision of *ten* cylinders, and at least *eight* sets of valve-gear, against, say, the three cylinders and two sets of valve-motion of a Gresley "Pacific," would appear to me to entail excessively high constructional and maintenance costs. Thirdly, booster driving gear is at present in the very earliest of experimental stages, so far as express passenger work is concerned, and there is as yet no guarantee of its successful working in conditions like these, where absolute dependence would be placed on booster capacity for rapid starting. The best feature of an engine of this character is the unlimited capacity for development of both boiler and fire-box. And now locomotive performance must claim our attention.

Some time ago—a long time ago, in fact—I made a promise to give details of running over the Midland Division of the London Midland and Scottish system between Derby and Manchester, which it is my present purpose to redeem. In the interim there has been so much of topical interest in the way of performance, as well as the necessity of making the outlook of these pages country-wide in its character, that the journeys in question have been crowded out, and so have accumulated to the tune of about 40 in all. The majority of the journeys—as is so often the case with Midland running—are singularly free from variation in the matter of times or speeds, and the limited selection of 16 tabulated, which are, perhaps, the best of the batch, will serve as representative of the whole. The various classes of locomotive in use all appear in the tables, and the series includes an experimental run of some note, in which superheated compound No. 1011 brought an exceptional load from Cheadle Heath to Derby, including the Horwich dynamometer car, in under schedule time, despite the fact that the train concerned (the 12.20 p.m. up) rarely keeps time with considerably smaller loads, unless piloted from Cheadle Heath to Peak Forest Summit.

The route concerned is undoubtedly a very hard one. Going northward from Derby, there is a gradual ascent for the first 21 miles to Rowsley Junction, averaging about 1 in 400 from 5 (Duffield) to 11½ miles, 1 in 200 from 14 to 16 miles (past Matlock Bath), and 1 in 400 again from 19 to 21 miles; 10½ miles out comes the exceedingly severe slack through Ambergate. From the junction south of Rowsley to a point above Miller's Dale, the gradient is round about 1 in 100 for 11½ miles continuously, save for short "breathers," each ⅜-mile long, down at the same inclination, one just below Bakewell, the next through Monsal Dale Tunnel, and the third across the viaduct to Miller's Dale Station. The final 3½ miles to Peak Forest are at 1 in 90, and the same gradient, now falling, follows almost uninterruptedly for over 9 miles to below New Mills South Junction, whence there is an easing to 1 in 100-140 for the next 8½ miles to Cheadle Heath. On to Manchester the remaining grades are mostly in favour of down trains, except the mile at 1 in 100 up into Central Station, which, however, is of little advantage to up expresses, owing to the severe slack enforced over the junction at Throstle Nest, just at its foot.

Most of my down journeys have been on the 1 p.m. out of Derby (10.25 a.m. from St. Pancras), and a selection of these figures in the first table. The first two show in comparison the work of non-superheated and superheated Class 2 4-4-0 engines respectively. No. 349 was delayed to Ambergate, attained 56½ m.p.h. before Rowsley, fell to 32 before Miller's Dale, and 28 at Peak Forest; but after Chinley there was some unusually fast running, with maxima of 71½ m.p.h. below Bugsworth, and of 75 before Cheadle Heath, so that net time showed a gain of 3 min.

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L.M.S. (MIDLAND DIVISION)—DERBY–MANCHESTER.

Distance.	Engine No. / ,, Type / Load (tons tare) / ,, (tons full)	Schedule.	349 NS 2 187 200	408 S 2 187 200	726 S 3 187 200	725 S 3 187 200	1016 S 4 162 170	Schedule.	727 S 3 183 195	748 S 3 183 195	748 S 3 183 195
Miles.		min.	m. s.	m. s.	m. s.	m. s.	m. s.	min.	m. s.	m. s.	m. s.
0·0	Derby	0	0 00	0 00	0 00	0 00	0 00	0	0 00	0 00	0 00
			p.w.r.				sigs.				sigs.
5·3	Duffield	—	9 40	8 35	8 45	8 15	9 25	—	8 35	8 05	8 50
			sigs.				sigs.				
10·4	Ambergate	15	16 45	14 45	14 35	14 00	16 00	14	14 15	13 40	15 50
										sigs.	
17·2	Matlock	—	25 15	23 25	23 05	22 15	25 10	—	22 30	23 10	24 55
21·6	Rowsley	29	30 05	28 10	27 50	26 35	30 05	27	27 05	28 30	29 35
25·0	Bakewell	—	35 10	32 45	32 25	30 45	35 00	—	31 30	33 05	33 50
27·3	Longstone..	—	39 25	36 50	36 10	34 20	39 00	—	35 15	36 45	37 25
31·4	Miller's Dale	44	46 30	43 20	42 20	40 30	45 30	41	41 45	42 45	43 10
						p.w.r.					
36·0	Peak Forest	53	55 35	51 40	50 25	49 25	53 20	49	50 00	50 00	50 20
41·6	Chinley	59	62 15	58 10	56 40	56 10	59 45	55	56 00	56 25	56 45
44·3	New Mills South Junc. ..	62	64 45	60 55	59 20	58 35	62 35	58	58 30	59 05	59 20
										p.w.r.	p.w.r.
53·4	Cheadle Heath	71	72 50	69 55	68 00	67 00	71 45	68	67 45	71 45	71 45
						sigs.					
57·2	Chorlton	78	77 55	74 45	sigs.	77 50	77 00	6	6 55	7 05	7 05
			sigs.	sigs.		sigs.					
61·4	Manchester	85	84 40	82 00	86 20	85 00	†82 50	13	12 25	12 30	12 25
61·4	Net times (min.)	85	82	80¾	79	76½	†80	*79	*78¼	*77	*77¾

S = superheater engine. NS = non-superheater engine. * Equivalent net time for non-stop run. † Schedule 81 min.

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No. 408 made the 85-min. run in a gross time of 82 min., despite concluding signal checks; for this class of engine the uphill work was excellent, the minimum speed at Peak Forest being as high as 35 m.p.h., while the downhill speed subsequently was most moderate, not exceeding 66 m.p.h. Both the performances of superheated Class 3 engines in the next two columns were excellent, and especially 725's effort. No. 726 attained 56½ m.p.h. before Rowsley, fell to 35½ on the 1 in 100 before Miller's Dale and to 29½ at Peak Forest, after which speed was rapidly picked up on the descent northwards, although intermediate "breathers" previously mentioned. Through Peak Forest there was a bad p.w.r. check costing us 1½ min.; and then followed speeds ranging from 69 to 74 m.p.h. down to Cheadle Heath, with slacks to 55 m.p.h. there and 60 through Chinley. But signal checks supervened, including a stop at Didsbury, which we reached (55·7 miles) in 69¼ min. from Derby, start to stop. The net time on this fine run was nothing over the 76½ min. shown—8½ min. less than schedule—and stresses the fact that these timings are distinctly on the easy side. The compound run—the only northbound com-

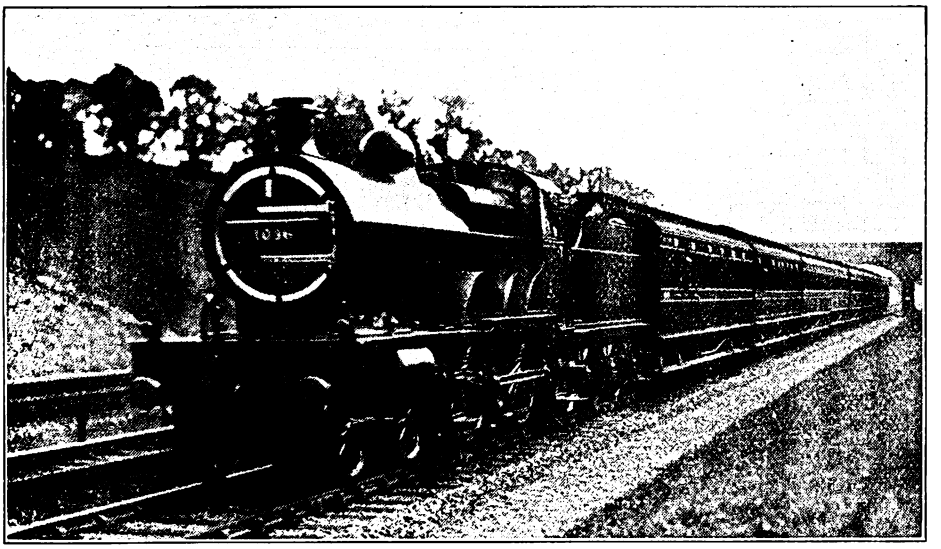

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*F. E. Mackay.*

Down Manchester express near Mill Hill.
Midland three-cylinder compound locomotive, No. 1036.

rigidly moderated below Chinley. But signal checks ruined the conclusion of the run.

The performance of No. 725 was easily the best of the northbound series in every respect; Fearnhead, of Trafford Park, was the driver. A speed of 60 m.p.h. was attained on the rising grades past Belper, and we reduced to 28 at Ambergate. Beyond Darley Dale we got up to 64 m.p.h.—an unusual maximum here—and then on the four successive stages of the ascent to Peak Forest we fell to 41½, 40, 31½ and 30 m.p.h., with momentary accelerations to 47½, 48 and 41 m.p.h. on the three pound-hauled train in my recent collection, strangely enough—was on the 5 p.m. train, allowed 81 min., and had no feature of note; minimum at Peak Forest was 32½ m.p.h., and an unnecessarily leisurely descent was made to Manchester.

The three concluding runs, on the 9.2 p.m. out of Derby, were all good, especially in their uphill work. This train, with a 2-min. stop at Cheadle Heath, included within an overall schedule of 83 min., and a load practically equal to that of the 85-min. non-stop 1 p.m. down, has a considerably harder task than the latter. No. 727 got a clear road, and despite a bad west wind

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L.M.S. (MIDLAND DIVISION)—MANCHESTER-DERBY.

Distance.	Engine No. / ,, Type / Load (tons tare) / ,, (tons full)	Schedule.	706 S 3 †205 †215	725 S 3 †228 †245	‖1013 S 4 †229 †245	‡1011 S 4 †255 †270	Schedule.	727 S 3 212 225	1026 NS 4 214 225	1012 S 4 211 230	1011 NS 4 219 235
Miles.		min.	m. s.	m. s.	m. s.	m. s.	min.	m. s.	m. s.	m. s.	m. s.
0·0	Manchester	0	0 00	0 00	0 00	—	0	0 00	0 00	0 00	0 00
								sigs.	sigs.		
4·2	Chorlton	7	5 45	5 55	5 55	—	7	7 40	7 00	6 00	5 55
			sigs.								
8·0	Cheadle Heath	13	13 25	11 40	‖11 35	0 00	12	13 40	13 15	11 15	11 50
12·0	Hazel Grove	—	8 35	9 30	8 00	8 40	—	20 00	19 00	16 45	18 10
17·1	New Mills South Junc. ..	14	16 30	18 20	15 45	15 40	26	28 35	27 30	25 45	26 50
19·8	Chinley	18	21 25	24 05	19 50	20 00	31	33 45	32 30	31 00	32 00
21·7	Chapel-en-le-Frith ..	—	25 10	28 20	22 50	23 15	—	37 35	36 25	35 25	35 40
25·4	Peak Forest ..	pass	pass	pass	‖29 15	pass	pass	pass	pass	pass	pass
		29	32 15	36 45	31 05	29 30	43	45 00	44 50	43 35	43 20
						sigs.					
30·0	Miller's Dale	34	36 50	41 35	36 55	34 40	48	50 00	49 45	48 35	48 25
36·4	Bakewell	—	42 45	47 40	42 40	41 00	—	56 30	55 45	55 00	54 40
39·8	Rowsley	44	45 55	50 30	45 45	44 00	58	59 45	58 45	58 10	58 05
			p.w.r.						sigs.		
44·2	Matlock	—	51 00	55 25	50 20	48 15	—	64 50	64 30	62 55	63 20
						sigs.					
51·0	Ambergate	56	58 55	63 20	58 10	56 35	71	72 05	72 50	70 15	71 10
56·1	Duffield	—	64 25	69 30	64 05	62 25	—	78 25	78 50	76 35	77 20
60·6	Nottingham Road ..	—	68 35	73 40	69 00	66 40	—	82 35	83 05	80 45	81 30
									sigs.		
61·4	Derby	68	70 00	75 10	70 35	¶67 30	83	84 00	85 00	82 30	83 05
61·4	Net times (min.)	*81	*80½	*86¾	*80¼	§66	83	82	81½	82½	83

S = superheated engine. NS = non-superheated engine. † Less 52/55 tons to Cheadle Heath. * Net actual running times (excluding loss by starting and stopping at Cheadle Heath). § Equivalent net time, Cheadle Heath into Derby Station. ¶ Signal stop outside Derby. ‡ With modified valve-gear: engine indicated and dynamometer records taken on this journey. ‖ 4-2-2 Pilot from Cheadle Heath to Peak Forest.

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and rain, attained 57 m.p.h. at Belper, 60 at Darley Dale, and fell to 41, 33½, 33½ and 30 m.p.h. on the four stages of the climb, with intermediate accelerations to 45½, 43½ and 43½ m.p.h. Speed from Peak Forest to Cheadle Heath ranged mostly between 65 and 68 m.p.h. No. 748, on her first effort, made quite a record start to Ambergate, with a maximum of 60 m.p.h. at Belper, but then slackened with unusual severity to 20 at Ambergate, and got signals badly on through Matlock. But we got up to 55½ m.p.h. before Rowsley, and the four ascending minima thereafter were 40, 39, 38 and 33½ m.p.h., as high as 41·6 m.p.h. Before the check at Disley, downhill speeds ranged up to 68 m.p.h., with frequent checks. A summary of the best times in this table gives 13¾ min. from Derby to Ambergate, 26¼ min. to Rowsley, 39¾ min. to Miller's Dale, 47 min. to Peak Forest, 53 min. to Chinley, 63½ min. to Cheadle Heath, and 73¾ min. to Manchester, or well under the pre-war 78-min. allowance of the best trains.

We have now to deal with the table of up journeys, which "features" chiefly the compound engines. The first four runs were made on the difficult 12.20 p.m.

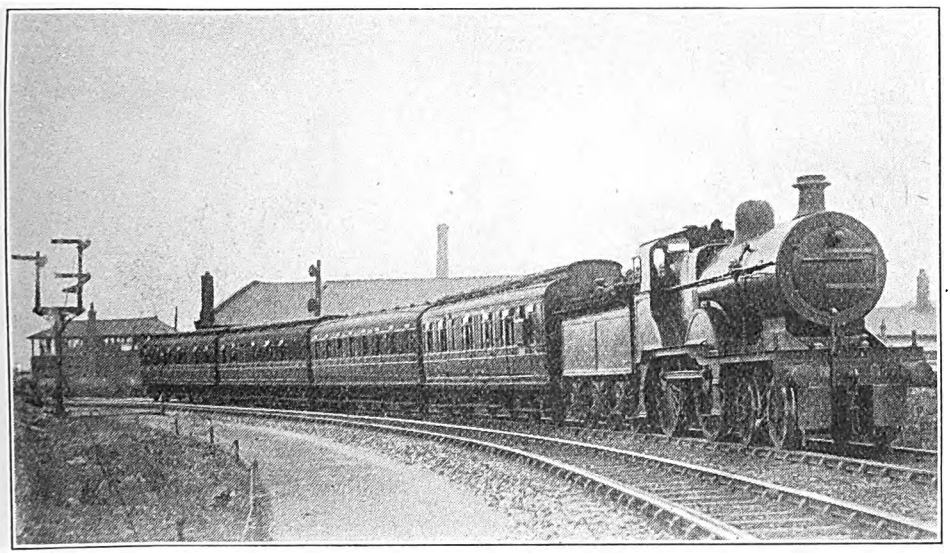

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*F. E. Mackay.*

Carnforth–Leeds train leaving Carnforth.
Midland re-built 4-4-0 locomotive, No. 456, class 2.

with intermediate speeds of 45, 49 and 48 m.p.h. A very cautious descent indeed followed to Cheadle Heath. On her second trip, after the initial signal check, No. 748's start was inclined to be sluggish to Matlock, but then we got away in fine style, with a maximum of 61 m.p.h. before Rowsley, and from Bakewell to Peak Forest our times were the best in the table. The four uphill minima were 41½, 39½, 40 and 34½ m.p.h., with momentary maxima of 48½, 50½ and 50½ m.p.h.—an extremely fine piece of uphill work; indeed, the *average* speed up the 1 in 100-90 from Rowsley to Peak Forest was for 14·4 miles up, whose actual running time is only 81 min. from Manchester to Derby, including stopping at and restarting from Cheadle Heath. As will be seen from the selection of runs given, time-keeping on this train is not of the best, even when a pilot is provided from Cheadle Heath to Peak Forest, as in the third run, although smart attaching at the former station occasionally gives a driver an extra minute or so to play with *en route* to Derby, in virtue of an early start. For a class "3" 4-4-0, No. 706 did well on the first run, keeping net time. Up the long 1 in 132 through Disley Tunnel,

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speed was maintained at 37 m.p.h., while the minimum on the 1 in 90 at Peak Forest was 30; down to Rowsley 67 m.p.h. was not exceeded, but a fine finish was achieved from Ambergate into Derby, with a maximum of 68 m.p.h. No. 725, in the next column, was clearly overloaded, no pilot being apparently available; loss of time was therefore to be expected. Speed through Disley was 33 m.p.h.; at Chinley it was 27, and at Peak Forest a shade over 25; top speed in descending to Rowsley was 68 m.p.h., but the best feature of the run was again the time of 11 min. 50 sec. from Ambergate to Derby, with a maximum of 64½ m.p.h. I give the next run, with an identical load, as a sample of piloted work—a 4-2-2 was attached from Cheadle Heath to Peak Forest—but the running was very poor and needs no further reference. The driver of No. 1013 rejoiced in the name of Hailstone, but there was precious little of the tempestuous about the running of his engine.

Indeed, the unpiloted No. 1011 in the next column, with a load greater by 25 tons, made considerably better times than the double-headed train, although I grant that No. 1011, to whose valve-gear certain alterations had just been made, was under close observation, and was going pretty well "all out" on the ascent. Some of the work performed was really remarkable. From Cheadle Heath the start is up 1 in 100-140-110 almost to Hazel Grove, where there intervenes ½-mile at 1 in 200; on this we accelerated to 42½ m.p.h. On the long 1 in 132 through and beyond Disley Tunnel we maintained the same speed, and the level ½ mile near New Mills—the only real break in the whole ascent—brought us up to 49½ m.p.h. On the subsequent 1 in 90 we fell to 37 m.p.h., and after a momentary increase to 38 on the slight easing of the grade through Chinley we fell gradually to 36 at the entrance to Dove Holes Tunnel, and left it at 34½ m.p.h., on the continuous 1 in 90 grade. After the severe signal check approaching Miller's Dale, we did some unusually fast downhill work, sustaining 74 to 75 m.p.h. below Longstone, until we reduced speed for Rowsley curve. We had then got up to 65 m.p.h. at Matlock, when a second vexatious check befell us at Matlock Bath. After this we attained 61 before the Ambergate check, and sustained 68 afterwards, being finally brought to a stand

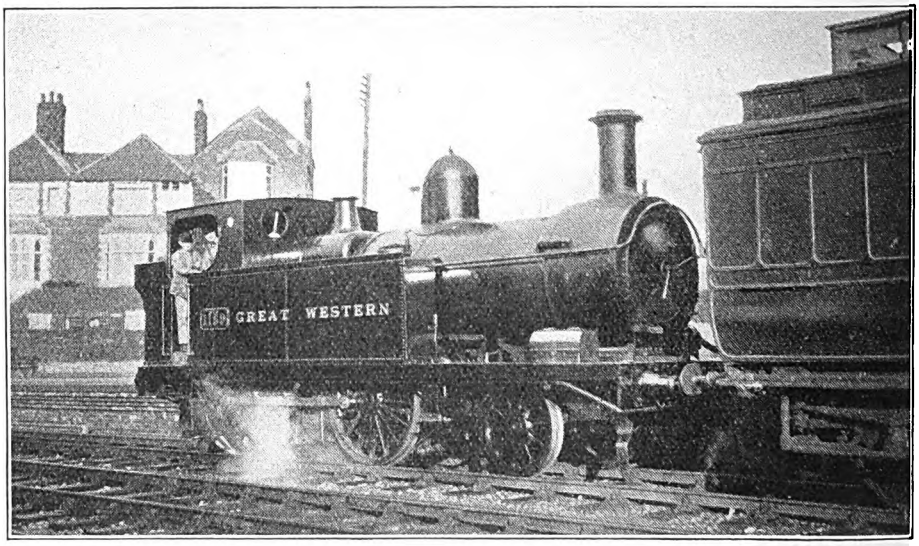

Photo.] GREAT WESTERN RAILWAY. [*J. Fox.*

Port Talbot 2-4-0 tank engine, No. 37, re-built as Great Western locomotive No. 1169, at Swindon, working Swindon Junction–Swindon Town service.

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by adverse signals just outside Derby Station. This run was, of course, by far the finest of all the up journeys in every respect, and shows the work of a superheated Midland compound at its very best.

The remaining up journeys show that the tendency to economise on time is considerably less on the up than on the down journey. No. 727 was stopped (as is very often the case with the 9.47 a.m. up, if it is started at the public time of 9.45 a.m.) at Cornbrook by adverse signals for 10 sec.; 33 m.p.h. was maintained through Disley Tunnel, 30½ through Chinley, and 28 to Peak Forest, after which the downhill going was moderate. In view of the 2 min. early start, we reached Derby 1 min. early; net time was a minute under schedule. The remaining runs were on the 4.35 p.m. up. No. 1026, Driver Mahoney, made the best run of the non-stop series; we lost 1¾ min. by signal delays at Cornbrook, passed Hazel Grove at 37½ m.p.h., entered Disley at 34½ and left it at 31½, passed Chinley at 31, Chapel at 29½, entered Dove Holes Tunnel at 26½ and passed Peak Forest at 25 m.p.h. Then came some speedy downhill work, speed reaching 70½ m.p.h. at Monsal Dale, and increasing from 68 at Hassop to 72½ before Rowsley, while we accelerated to 65 after the Matlock check, and sustained 68 between Ambergate and Derby. No. 1012 had a clear road throughout; we touched 57½ m.p.h. at Withington, fell from 34½ to 31½ in Disley Tunnel, and passed Peak Forest at 26, after which we did not exceed 68 on the way down to Rowsley. Lastly, No. 1011, in pre-superheat days, left Disley Tunnel at 33 m.p.h., passed Chinley at 30½, maintained 29½ steadily through Dove Holes Tunnel, but fell to 27½ at Peak Forest through premature notching up; then we did not exceed 65 m.p.h. down to Rowsley, where a very exaggerated slack was made to 33 m.p.h.; while, finally, we touched 67 between Ambergate and Derby. A summary of the fastest up point-to-point times gives 11 min. to Cheadle Heath, 27½ to Chinley, 36¾ to Peak Forest, 41½ to Miller's Dale, 50 to Rowsley, 61¾ to Ambergate and 74 to Derby; the end-to-end times in both directions are thus in close agreement, and show both north- and south-bound journeys to be of approximately equal difficulty.

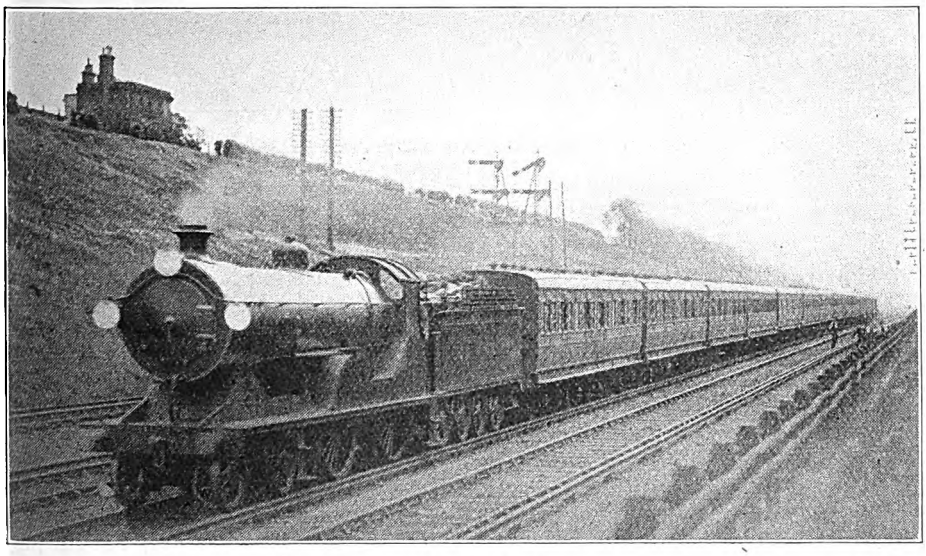

Photo.] SOUTHERN RAILWAY. [*F. E. Mackay.*

Up Bournemouth express. London and South Western 4-4-0 locomotive, No. 472.

As an example of what the superheated Midland compounds can do in the matter of speed over comparatively level track, the following snippet, timed by a

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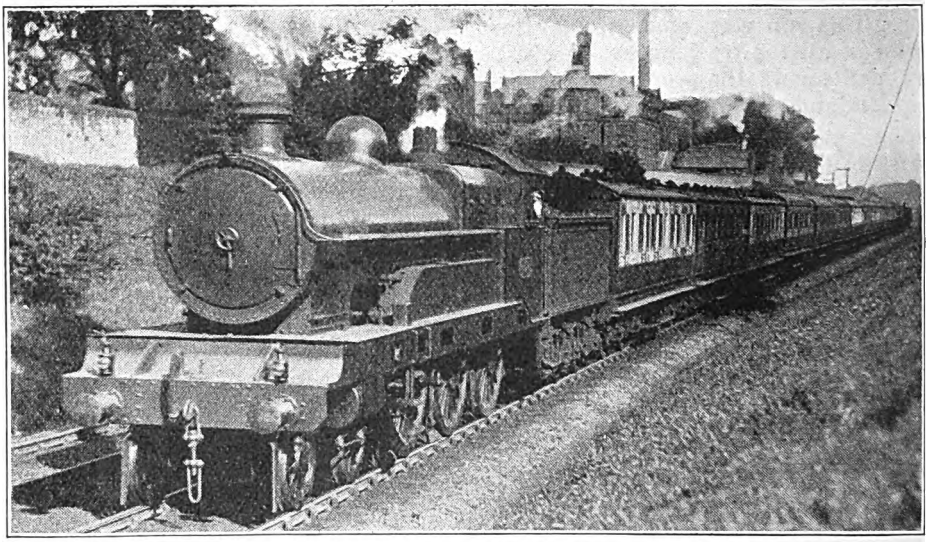
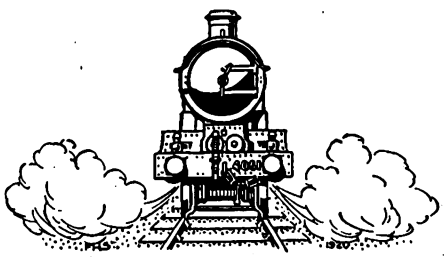


Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*F. E. Mackay.*

Lake District–London express near Lancaster.
Four-cylinder 4-6-0 locomotive, No. 8. (Bank engine in rear.)

correspondent, is of considerable interest. The train was the 6.25 p.m. from St. Pancras to Manchester; the load was 210 tons all found, and the engine No. 1039, driven by Richardson, of Kentish Town. Out of Leicester, Syston, 4·7 miles, was passed in 6 min. 59 sec., at 64½ m.p.h.; Loughborough, 12·5 miles, in 13 min. 53 sec., at 75 m.p.h.; and Kegworth, 17·3 miles, in 17 min. 51 sec., at 70⅔ m.p.h., after an intermediate fall to 69. The 118 mile-post, a shade under 19 miles from Leicester, was passed in 19 min. 21 sec., and "even time" would have been reached shortly after, but for severe signal checks from there on to Derby. The route from Leicester to Trent is chiefly falling at about 1 in 500, with intervening level strips, but this detracts very little from the merit of the performance. Next month I hope to detail some of the exploits of No. 1033, of the same type, on the 2-hour Euston-Birmingham expresses, together with certain electrifying achievements—including a maximum speed of 83 m.p.h. between Cheddington and Leighton, an *average* of 82 between those points, of all but 80 throughout the 16·3 miles from Cheddington to Wolverton, and of 77·7 over the 23·1 miles from Tring to Castlethorpe!—behind London and North Western engines on the same service.



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Diesel-Electric Rail Motor Cars and Locomotives.

IN the RAILWAY MAGAZINE for November last we described the trials being made with a steam turbine-electric locomotive, following those with an earlier design some years ago. The Heilmann steam-electric locomotives tried in France still further back may also be recalled. During more recent years, a number of petrol-electric rail cars have been introduced on various lines abroad, and examples were, and we believe are, still in existence on the late Great Central, London and North Western and Great Western railways.

In Sweden, however, there have been for some years past passenger railway services performed by means of Diesel-electric motors. Electric railways are not uncommon in that country, the water power available making the generation of current inexpensive; but there are many parts of Sweden where water power in sufficient volume is not available, while the small number of railway passengers is not sufficient to make remunerative the running of ordinary steam trains. The General Swedish Electric Company, usually referred to in that country as the A.S.E.A., took up the subject of working such traffic by means of rail motor cars propelled by Diesel-electric machinery. The first of these cars, for particulars of which, as also of other cars described, we are indebted to Mr. Harold M. Briggs, was put into service in September, 1913. It was of 75 h.p., and provided accommodation for 51 passengers, its weight unloaded being 28¾ tons. The latest type, introduced in 1922, is of 250 h.p.

The chief claim put forward for the Diesel electrically propelled railway car is its high efficiency compared with petrol motors and steam locomotives. The useful work of the Diesel engine is said to amount to 30 to 35 per cent. of the thermal value of the fuel, and that of petrol internal-combustion engines 20 to 22 per cent., whilst the steam locomotive is credited with using only 3 to 4 per cent. of the heat evolved, from 96 to 97 per cent. of the fuel heat escaping up the chimney. The economy of the Diesel engine compared with that of the steam locomotive depends largely upon the relative cost of the fuel employed. Last year a Diesel-electric rail motor of 160 h.p. running daily between Halmstad and Nassjo and back, with a total daily mileage of 245, usually hauled a train, including the trailer, weighing 79 tons. The ascending gradients are severe, 1 in 167 for 12½ miles in one direction and for about 17 miles in the other, but the average consumption of fuel oil amounted to but one thimbleful per passenger per kilometre (1,093 yards). The price of the fuel, crude naphtha, was 8½ ore per litre (about ¾d. per pint), and 0·45 kg. were consumed per kilometre run (about 2·1 lb. per 100 ton-miles).

Diesel-electric rail motors are running on 4 ft. 8½ in. and 2 ft. 11 in. gauge railways in Sweden. The horse-power of these cars for both gauges are 75, 120, 160 and 250. The chief dimensions of the 75-h.p. car for the standard gauge are:—

Length over buffers	52 ft. 5 15/16 in.
Length over car body ..	49 ft. 6½ in.
Width outside	10 ft. 4 in.
Height from top of rail ..	12 ft. 1¾ in.
Height of compartment inside	7 ft. 8½ in.
Total wheel base	32 ft. 9 11/16 in.

The car contains, in addition to engine room and luggage compartment, two third-class compartments with seats for 41 passengers and a second-class compartment for 10 passengers. Two folding seats are provided in the driver's compartment at the rear end of the car. If desired, one third-class compartment can easily be arranged as a post office compartment, Although the car is apparently supported on two 4-wheel bogies, the arrangement is described as "four free flexible axles." The essential feature of this arrangement is the play between axle-box and horns, which amounts to 1 in. more or less,

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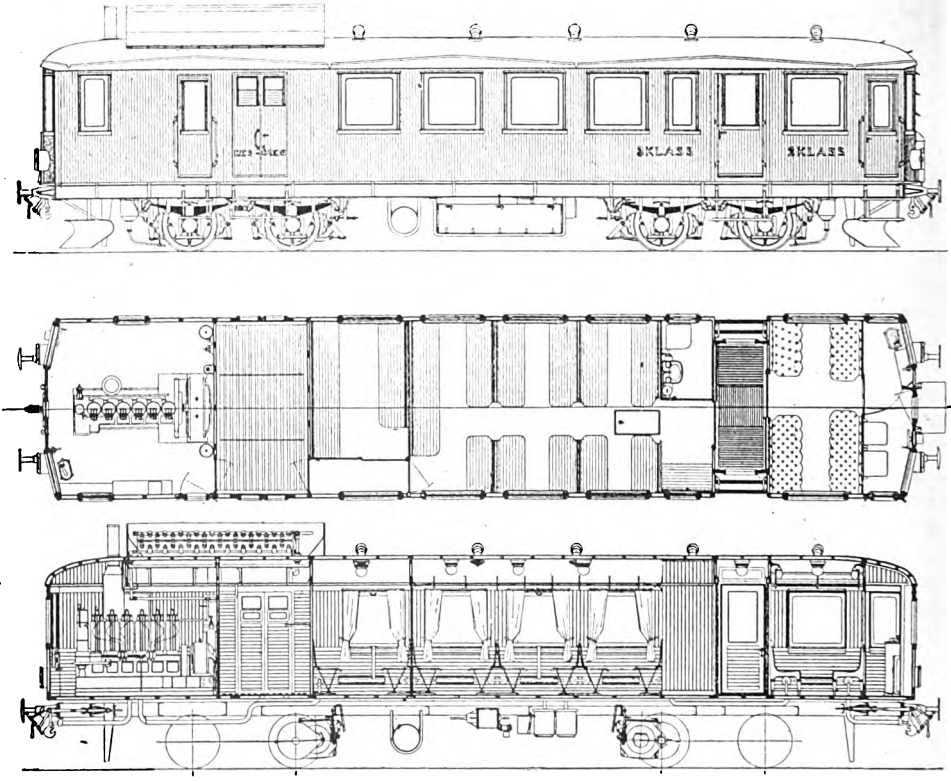
depending upon the distance between the axles. This arrangement leaves the axle free to take up a radial position when running round a curve, being brought back again to its normal central position by the weight of the car body acting through the spring links. The bearing springs of the two axles are connected by balance beams or equalisers at each end. The whole arrangement reduces



DIESEL-ELECTRIC MOTOR CAR, TYPE I, SWEDISH STATE RAILWAYS.

weight, permitting the use of the car on lines of light construction and has proved to be satisfactory. The smooth and free running is very noticeable, even at speeds of from 43 to 50 m.p.h. The car is entered by a small vestibule or passage between the second and third-class compartments, on one side of which there is a toilet room.

A compartment for the driver is situated at the extreme end of the car, opposite to the engine room, with direct entrance from the outside. The door between it and the second-class compartment is closed when the car is travelling in this direction. The whole width of the car is open to the driver, who is thus in a position to keep a good look-out on both sides of the track. When the car is being driven from the engine room end this door cuts off communication to the controller room, where sundry apparatus and instruments are located. The remaining part of the compartment, in which two folding seats are provided, is left accessible to the passengers.

The car body is mounted on a strongly constructed frame built up of suitable channel iron and is constructed of oak and outside sheathing of teak. The seats in the third-class compartment are of varnished pine, the second-class seats are arranged with removable cushions and backs. At both ends, doors, gangways, footplates, and gates are provided for communication to trailers, also necessary rail guards and brackets for fixing snow ploughs and motor protecting beams.

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Hand-operated and automatic air pressure brakes are provided, with necessary handles for both systems, at each end.

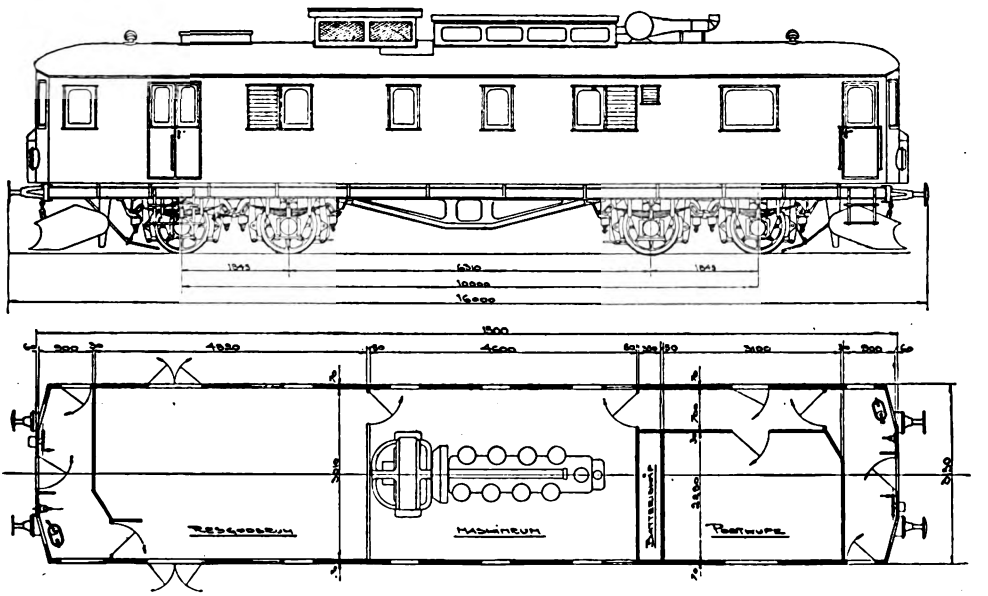
During the winter the car is warmed by the heat evolved in the process of cooling the Diesel engine. This system serves a system of radiators or pipes under the seats. Electric lights are provided and connections for lights in trailer cars. Driver's compartments with all necessary fittings and instruments are provided at both ends; there is therefore no need for turning the car. Power for propelling the car is supplied from the Diesel engine and is transmitted electrically to the two driving motors.

The complete power installation consists of:—

1 75-h.p. Diesel engine.
1 direct-coupled continuous current generator.
2 electric motors.
1 storage battery.
2 controllers and necessary meters and gauges.

The Diesel engine is 6-cylinder, 4-cycle, developing 75 b.h.p. when running at its normal speed of 550 revolutions per minute. For short periods this power may be increased by about 20 per cent. The starting valve as usually fitted to Diesel engines is not required in this case as starting is effected electrically. Compressed air, for blowing fuel oil into the working cylinder, is supplied by a two-stage compressor driven from a crank-pin on a main shaft. When starting, and before the engine has attained sufficient speed for the compressor to deliver air at full pressure, the requisite air is supplied from a separate air reservoir which is charged automatically while the engine is running at normal speed.

As already mentioned, the Diesel engine is started electrically, the generator acting as a motor and receiving current from a storage battery. The engine can be started from either controller, it attains full speed in a few seconds, and is then ready to start the car.



160-H.P. DIESEL-ELECTRIC LOCOMOTIVE, SWEDISH STATE RAILWAYS.

Electric machinery transmits the tractive force created by the Diesel engine to the two driving axles, the arrangement being such that the full power of the engine is available at any speed at which the car may be travelling.

A motor car of this type with trailer of a total weight of 40 tons, running at 33 m.p.h. on the level, maintains 24 m.p.h. on a 1 in 200 rising gradient, 17½ m.p.h. on 1 in 100, and 11¾ m.p.h. on 1 in 60. A Diesel-electric rail motor for 2 ft. 11 in. gauge of 75 h.p. is generally similar

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to that already described, but is supported on two 4-wheel bogies. It carries 28 third-class and eight second-class passengers.

The 120-h.p. Diesel-electric motor cars for both gauges have no passenger accommodation, and are therefore Diesel-electric locomotives, and their length is less than those carrying passengers and their weight greater—32¼ tons for the normal gauge and 27⅛ tons for the narrow gauge. These locomotives will haul trains of three or four cars, seating 130 to 150 passengers, and of a total weight, including engine of 70 to 80 tons, at speeds about the same as those mentioned above.

The average cost of running a 75-h.p. motor car on the normal gauge Mellerstra-Söndermanlands Railway for three years and eight months, with a trailer for 18 per cent. of the total mileage, was 3·58d. per mile. This figure includes the wages of driver and guard, fuel and lubricating oil, cleaning, maintenance, &c. A light steam train for branch service, consisting of small locomotive weighing 48 tons, a brake van and a composite coach for 58 passengers total weight (including passengers, luggage and locomotive) 88 tons, cost for locomotive expenses 6·94d. per mile run. The carriage expenses and interest and depreciation on locomotive and carriages brought the total up to 10·8d. per train-mile.

A Diesel-electric motor train, 75-h.p. engine and one trailer, seating together 83 passengers and weighing fully loaded 47 tons, cost for engine services 3·68d. per train-mile. Adding the charges for carriage service, interest and depreciation as in the steam train, the total cost is 6·5d. per train-mile. The initial cost of the steam locomotive is given as £2,360, and of the 75-h.p. Diesel-electric car as £3,490.

The former requires two vehicles of an initial cost of £1,743, and the Diesel set one 4-wheel trailer costing £506. But we do not understand why inexpensive vehicles such as the trailer costing only £506 cannot be used with the steam locomotive.

DOWN WEYMOUTH EXPRESS, GREAT WESTERN RAILWAY.

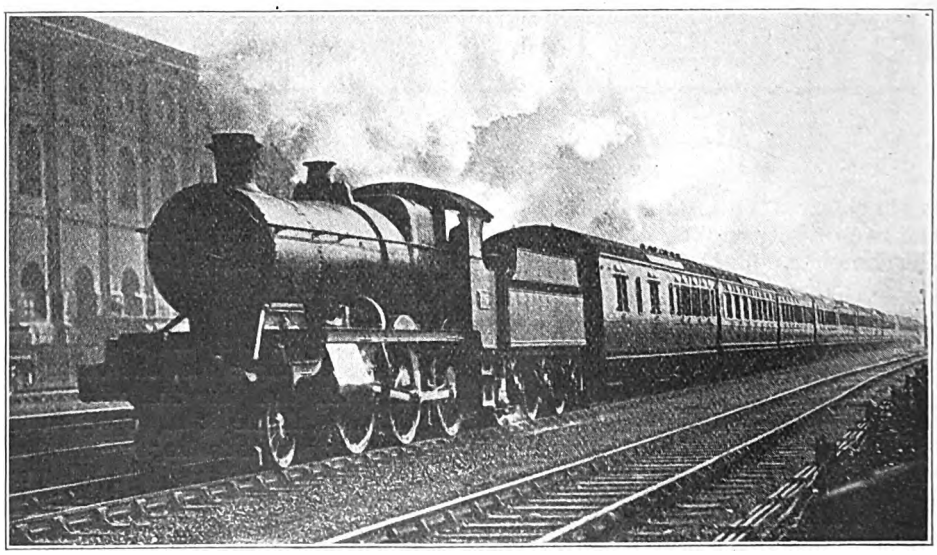

Photo.] 2-6-0 LOCOMOTIVE No. 6307. [*F. E. Mackay.*

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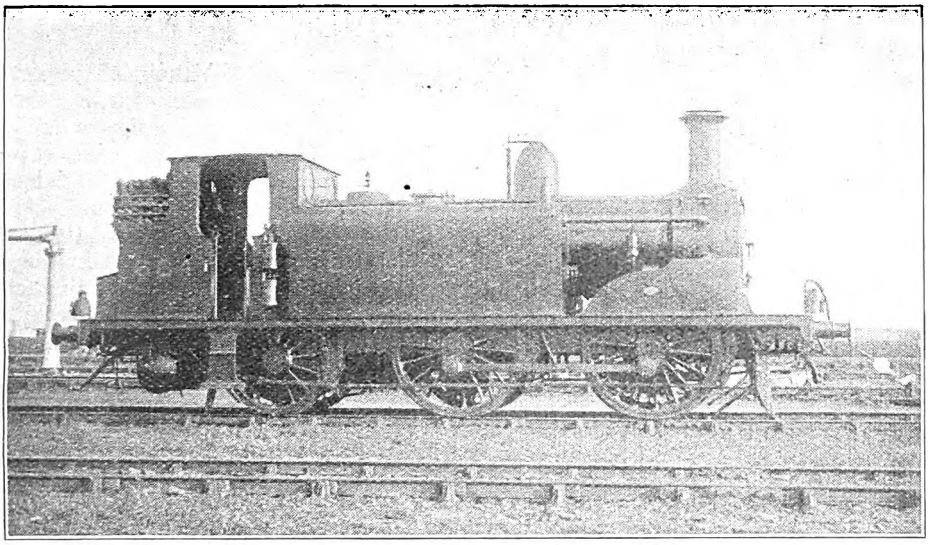

No. 1, "SYDENHAM" (now No. 684) [PHOTOGRAPHED] ON ITS FIFTIETH BIRTHDAY.

Jubilee of a Famous Locomotive Class.

MR. STROUDLEY'S 0-4-2 TYPE TANK-ENGINES, SOUTHERN RAILWAY, BRIGHTON SECTION, 1873–1923.

By J. N. MASKELYNE, A.I.Loco.E.

ON November 24, 1873, the first of the late Mr. William Stroudley's well-known 0-4-2 tank engines, No. 1, *Sydenham*, was completed at Brighton Works, and in the following month five sister engines made their appearance. From that time until March, 1887, the class, officially styled "Class D1," continued to multiply until it consisted of 125 engines whose sphere of usefulness has extended far beyond the limits of that for which they were primarily intended. They were not all built at Brighton, for between October, 1881, and March, 1883, thirty-five were built by Neilson and Company, of Glasgow.

However, of the original total number, 110 are still at work, and it seems that the older they grow the more energetic they become, because the duties upon which a large number are now engaged must be considerably harder than those for which they were originally designed. That is to say, the loads have increased and the speeds between stopping places have been quickened, and this involves really hard work for such comparatively diminutive machines. All the same, these sturdy little engines seem to be quite capable of any of the duties assigned to them.

It is not claimed that fifty years of existence for a locomotive is in any way unique, so far as this country is concerned, for there are many engines, at work on other railways, which are as old or older; but, in the case of the Stroudley tanks, a fact that is worth pointing out is that many are still actively employed on the heavy and arduous suburban traffic of the line, whereas, on other railways, old engines, with few exceptions, are usually relegated to relatively light duties.

A further interesting fact concerning the Stroudley tanks is that, out of the six original engines of 1873, four are emulating a certain popular brand of alcoholic beverage and "still going strong"! These

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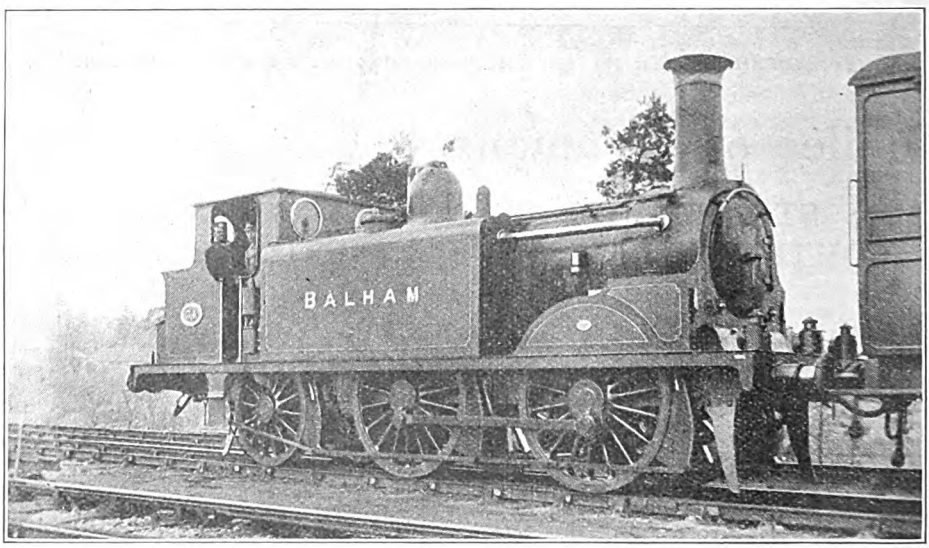
four engines are old Nos. 1, 2, 5 and 6, now renumbered 684, 298, 605 and 299 respectively.

At various times, nearly all the "D1" class engines have been rebuilt, though many of them are still carrying boilers of Mr. Stroudley's design, nearly 40 years old. Now, in the case of many modern "rebuilds," very little of the original engine is retained; but this remark hardly applies to No. 684 and her sisters, because under both Mr. R. J. Billinton and Mr. D. E. Marsh, the rebuilding consisted simply of supplying new boilers of somewhat modified design, though of similar dimensions to the old ones, except in one solitary engine which will be referred to directly. In nearly all other respects, except in minor details, the engines remain as originally built, which is fine testimony to the original design, and is but another instance of the care, forethought and first-class workmanship that Mr. Stroudley put into his creations. Mr. Marsh supplied additional coal-rails to the bunkers of all the engines of the class, and he fitted side-tanks of a somewhat modified form to No. 248.

The solitary exception to the rebuilding scheme just outlined is No. 216, formerly No. 20, *Carshalton*. This engine was rebuilt by Mr. Marsh in December, 1910, with a boiler of much greater diameter than the original one. Although this engine has contributed a very large share of good, solid hard work, the results obtained from the increased boiler capacity have not, apparently, been sufficient to justify the similar treatment of any of the other engines of the class. Probably the 4 tons increase in the total weight has been one of the deciding factors in the matter. No. 216, by the way, was restyled Class "D1X" upon being rebuilt, and has remained thus the one member of her class ever since.

Whether the general efficiency of the class, as a whole, has been improved by the rebuilding, or reboilering, is a question which need not be answered, but, at any rate, these little engines are still able to carry out their duties in a thoroughly energetic and satisfactory manner, as anyone who studies their daily work on the London suburban traffic at the present time can testify. To find a "D1" tank on a train bound for so distant a destination as Tunbridge Wells, for example, is by no means an infrequent occurrence; and although on this service they are usually employed on the lighter trains, the route is not an easy one, especially *via* Oxted, so that the work to be done is of quite a high order.

But it is on the purely suburban traffic in and on the outskirts of London that



No. 34, "BALHAM," AS ORIGINALLY BUILT.

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these engines have done, and many are still doing, invaluable work, and as an instance of what they can do the following may be of interest. Only a few weeks ago No. 248 astonished the writer one evening by hauling a train of nine eight-wheeled coaches, all crammed to excess and representing a load of some 180 tons behind the engine, from London Bridge to Norwood Junction, 8½ miles, in 14 min. 15 sec., start to stop. As this included the 2¾ miles climb of 1 in 100 up the Forest Hill bank, to say nothing of an annoying series of slight signal checks between London Bridge and South Bermondsey and again at New Cross Gate, which effectively prevented anything in the nature of "rushing" the bank, the performance was one of outstanding credit, and would not have shamed a larger engine. The minimum speed at the top of the bank was 32·1 m.p.h., and the maximum, when steam was shut off for the Norwood stop, was 52·9 m.p.h. This run is, however, but little better than the average typical performance by "D1" tanks on this stretch of line, and has been beaten by bigger engines only twice in the writer's experience.

Another but less recent incident, in which a "D1" tank played a leading part, is well worth recording. One Sunday, in February, 1921, the famous "Southern Belle" express, consisting of the then full complement of seven Pullman cars, was in charge of No. 77, one of the superheated 4–4–2 type express tank engines of Class "I3." The writer was on the train at the time, and we had not proceeded far out of Victoria station before it became abundantly clear that things were not all well with No. 77. It was learnt afterwards that her sanding gear had developed some fault at the last moment and refused to function properly, with the result that, after much violent slipping, she came finally to a standstill about half-way up the Grosvenor Road bank. A delay of about ten minutes ensued, and then a "D1" tank, whose number, unfortunately, could not be ascertained definitely, but there are strong reasons for supposing that it was No. 616, came to our assistance in the rear. That No. 616 did the lion's share of getting the train moving again was quite evident from the fact that, while No. 77 began to indulge once more in a series of frequent and violent slips, the steady, regular but noisy exhaust of the small engine behind showed that she, at any rate, had matters well under control at her end! And she continued to push until we were well across the Thames, when No. 77 whistled a signal, presumably of thanks, indicating that assistance was no longer required, and we left our gallant little helper to go back to her "Pilot" work in Victoria station.

An account of a very similar occurrence has been sent to the writer by a friend, who was an eye-witness, while this article was in course of preparation. On October 10 last, No. 34, one of the smaller 4–4–2 type tank engines of Class "I4,' in charge of an empty ten-coach long-buffered suburban "set" train, bound for Eardley Road sidings, was stopped by signal on the sharply rising approach to the fly-over junction at Streatham Common. Upon the signal being lowered, all efforts to start again were futile. Eventually No. 34 gave up further attempts to start and assistance was then brought in the shape of the following train: A seven-coach close-coupled passenger train, bound for Epsom, which drew forward on to the "stalled" train, and then propelled the whole lot up the bank, No. 34 slipping vigorously all the time and apparently useless. The engine of the Epsom train was Stroudley "D1" tank No. 225!

At this point, it seems worth while to comment upon the extraordinary hauling powers the "D1" tanks seem to possess. To see one in charge of a heavy suburban "business" train almost borders upon the incongruous, for the load appears to be out of all proportion to the size of the engine. Frequently, it happens that when any of the larger tank engines of Mr. R. J. Billinton's or Mr. D. E. Marsh's designs have to be stopped from duty, owing to some defect, a "D1" tank is commissioned to take the place of the larger engine until the necessary repairs to the latter have been made. Under these circumstances, the little "D1" tank may find herself called upon to handle trains weighing anything up to 200 tons, which is no light task for a small engine, especially when the very numerous starts and stops made in the course of a journey are taken

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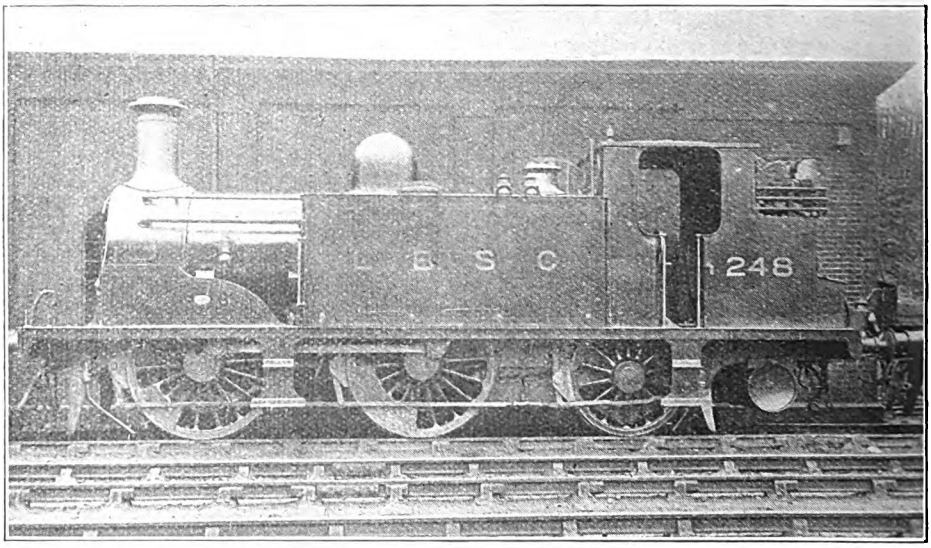
into consideration. However, the use of these little engines on such work as this is becoming somewhat rarer than formerly, a matter for regret to admirers of the "D1" class.

But a new sphere of usefulness has been found for them. During the past five or six years, several of the class, including the venerable No. 684, have been fitted for "motor-working," and when not engaged upon more exacting duties, they put in an enormous amount of useful work hauling "auto-trains" on branch lines or short local trips in busy centres. On this sort of work they have proved to be so successful that others of the class will probably be converted, and thus they will be used for many years to come.

The wonderful reputation of these engines is attested by the locomotive men all over the system. There is hardly a shed which has not a few "D1" tanks stationed there, and while most of the class were stationed at one time in the neighbourhood of London, the majority are now to be found in the country districts, usually at work on rather lighter and less arduous, but not less useful duties than when in London. The writer has yet to discover a "Brighton" locomotive man who has any complaint to lodge against the "D1" tanks, and there are comparatively few classes of locomotives, anywhere, of which this can be said, for a class of engines often has a good name among the men in one district but quite the reverse in another!

As is often the way with a numerous class of locomotives, several of the "D1" tanks have been re-numbered from time to time, in order to facilitate the numbering and classification of new engines built at much later dates. This re-numbering seems to have occasioned some difficulty to not a few people who are interested in such matters; and no wonder, for, at this distance of time, the scheme appears to be somewhat complicated, since some of the engines have been re-numbered on as many as four different occasions! The following list is given for what it may be worth, and, so far as the writer is able to trace, it is complete:—



No. 248, AS FITTED WITH NEW BOILER AND HIGH-SIDED TANKS.

No. 1 became No. 684 in 1907.
No. 2 became No. 75 in 1907, and 298 in 1909.
No. 5 became No. 605 in 1907.
No. 6 became No. 76 in 1907, and 299 in 1909.
No. 7 became No. 607 in 1907, and was scrapped in December, 1912.
No. 12 became No. 612 in 1907.
No. 13 became No. 77 in 1907, 77A in 1909, 347 in 1913 and, finally, 214 in 1920.
Nos. 14, 15, 16 and 17 became Nos. 614, 615, 616 and 617, respectively, in 1907.

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No. 18 became No. 78 in 1907, 78A in 1909, 349 in 1913, and, finally, 215 in 1920.

No. 19 became No. 619 in 1907, and was scrapped in December, 1913.

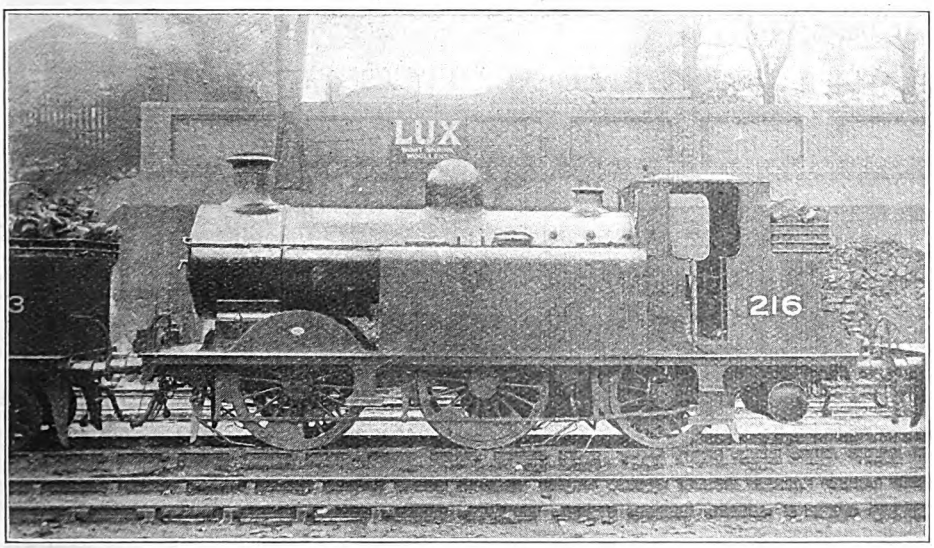
No. 20 became No. 79 in 1907, 79A in 1909, was rebuilt as Class "D1X" in December, 1910, renumbered 349 in 1913, and, finally, 216 in 1920.

No. 21 became No. 621 in 1907, and was scrapped in December, 1912.

Nos. 23, 24, 25, 26 and 27 became Nos. 623, 624, 625, 626 and 627, respectively, in 1908.

No. 28 became No. 628 in 1908, and was scrapped in December, 1912.

No. 29 became No. 629 in 1908.



No. 216, REBUILT AS CLASS "DIX."

No. 30 became No. 630 in 1908, and was scrapped in December, 1913.

No. 31 became No. 631 in 1908.

No. 32 became No. 80 in 1907, 80A in 1909, 350 in 1913, and, finally, 217 in 1920.

Nos. 33 and 34 became 633 and 634, respectively, in 1908.

No. 35 became No. 298 in 1878, 698 in 1909, and was scrapped in August, 1923.

No. 36 became No. 299 in 1878, and 699 in 1909.

Nos. 351, 352 and 353 became Nos. 218 219 and 220, respectively, in 1920.

It will be noted that some numbers between 1 and 36, in the above list, are omitted, since the engines which bore those numbers were never re-numbered, but were scrapped at the following dates: No. 3 in 1903; Nos. 4, 8, 9 and 10 in 1904, No. 11 in 1906, and No. 22 in 1907.

Later engines which have been scrapped are No. 222 in August, 1923, and No. 263 in December, 1913.

The complete list of the "D1" Class, as at present running, is, therefore, as follows:—

Nos. 214, 215, 217–221, 223–262, 264–299, 354–362, 605, 612, 614–617, 623–627, 629, 631, 633, 634, 684 and 699.

To this list, strictly speaking, should be added the solitary member of Class "D1X," No. 216, since her only claim to difference from her sisters is her larger boiler!

Now that the "Brighton" line has become a section of the Southern Railway, it is possible that the "D1" tanks, in common with the other engines of the Brighton section, may again come in for re-numbering. Exactly what form this fresh re-numbering, if it comes, will take is not yet known, but, surely, it will constitute something of a record if a few of the engines receive a new number for the fifth time in their existence?

In concluding this somewhat scanty appreciation, it must be pointed out that, although the pioneer engines of the class

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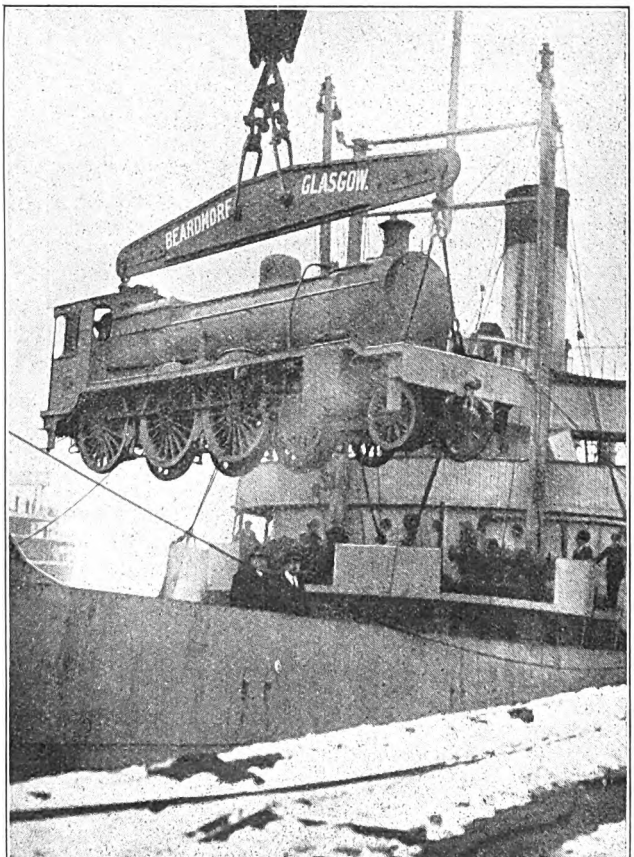
have reached the age of fifty years, their younger sisters have still to attain the forty mark. Therefore, it is to be hoped that a few, at any rate, may still be found ten years hence doing useful work somewhere on the Southern Railway.

For more than a generation they have been familiar little objects to all locomotive enthusiasts in South London, and during the latter part of that time their appearance has sadly changed. Shorn of the smart yellow livery, copper-capped funnels and other essentially "Stroudley" characteristics, they no longer present that trim aspect that they did. But their extraordinary capacity for hard work still remains, and it would be interesting if it could be ascertained how many times they have earned their cost for the Company that owned them.

Acknowledgments must be made to Mr. A. D. Jones, Locomotive Running Superintendent of the Southern Railway, for facilities for taking the photographs reproduced, and especially in regard to the "Fiftieth Birthday" photograph of No. 684.

SHIPPING LOCOMOTIVES TO INDIA.



THE shipment of locomotives, fully assembled, is not new, but such cargoes have up till quite recently been confined to short sea passages. The enormous advantages in time, labour, and convenience of transporting railway engines in this manner has given rise to the experiment being tried for much longer voyages.

The view reproduced shows one of 25 4-6-0 type passenger locomotives, built by William Beardmore & Co. Ltd. for the Bombay, Baroda and Central India Railway, being lifted on board the s.s. *Belfri*. The builders' locomotive works are adjacent to their Dalmuir shipyard and fitting-out berths, the latter being equipped with a 200-ton cantilever crane. The distance of this crane, on the quayside, from the locomotive works is only 300 yards, and with the available railway lines, the short journey, the loading up of the engines, each of which weighed 66·6 tons, was a comparatively simple matter.

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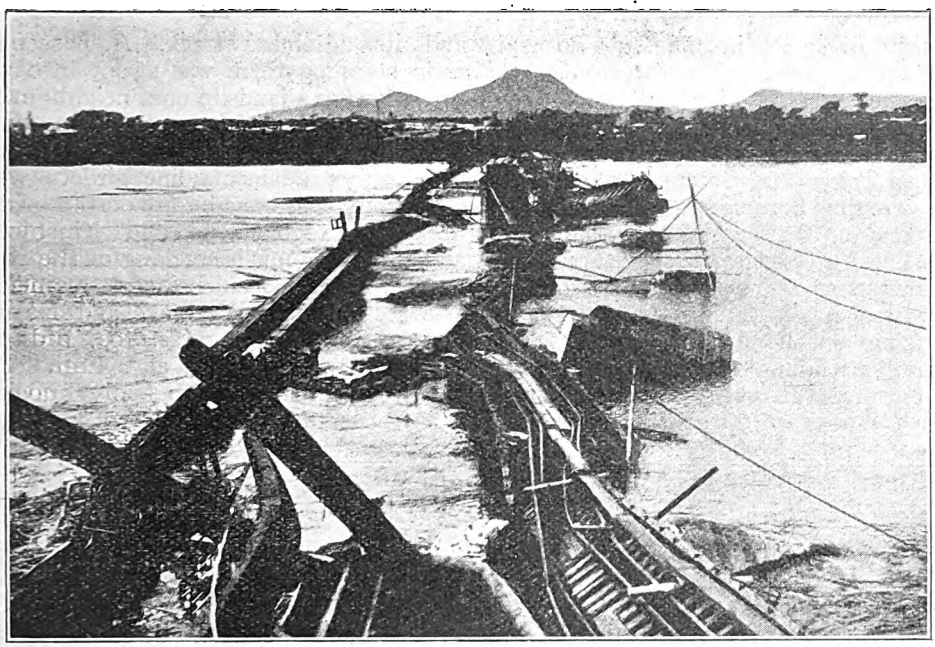

BANYUGAWA BRIDGE TOKAIDO LINE.

Japanese Railways and the Great Earthquake.

IT may be recalled that the earthquake occurred on September 1 last, at 11.58.44 a.m., and practically destroyed many of the flourishing cities and towns in the Kanto regions, in the main island of Japan, including Tokyo and Yokohama. The maximum shock was experienced at Yokohama, Ofuna, Kamakura, Hiratsuka and Odawara, in the Tokaido region, and at the Boshyu Peninsula. The great damage done in Tokyo was chiefly from the fire that swept the greater part of the city soon after the first shock, but destruction of the Yokohama piers and in the commercial districts of the city, and of railways, embankments, bridges, &c., in the southern districts, were the direct result of the earthquake, and show the extent of the destructive agency in that region.

The headquarter offices of the Railway Department escaped an immediate collapse from the shock, though practically all walls and plastered portions were shaken down and were afterwards consumed by the fire which raged in the adjoining buildings. The chief railway buildings lost by fire, besides the headquarter offices, were as follows :—

Tokyo Railway Hospital, Departmental Institute for Training Railway Employees, Lumber-Preservation Shops, District Superintendence Offices for Operation at Shimbashi, Ueno and Ryogoku, District Road Engineer's Offices at Shimbashi, Ueno and Ryogoku, Shinanogawa Electricity Office Building, and the Eirakucho Electric Sub-Station.

The following station buildings, among others, were also destroyed : Shimbashi, Yokohama, Sakuragicho, Manseibashi, Ueno and Ryogoku, whilst the undermentioned were burnt : Kinshicho Car-Repairing Shops, Shiodome Freight Terminals, Sumidagawa Branch Office of Omiya Shops, Electric Generating Plant of Omiya Shops (collapsed), the Blacksmithy, Erecting and Testing Sections of Omiya Shops (partly destroyed by earthquake). The total number of stations

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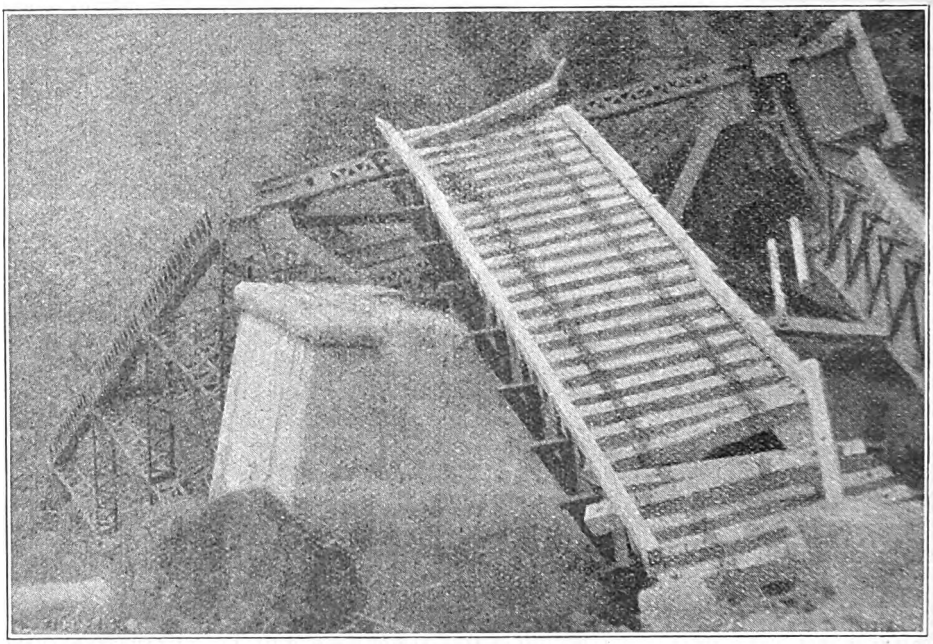
seriously damaged in the Tokaido and the Boshyu Peninsula Lines were 46.

On the Tokaido Line there was considerable levelling and falling or cracking of embankments at numerous places between Tokyo and Gotemba, also a collapse of the Banyugawa River Bridge (28 spans of 70 ft. each, comprising two single lines), all except five spans of up-line and four spans of down-line. In addition, there was much falling, bending, and displacing of the track near Matsuda station, and falling of earth and sand at the entrance of the Yamakita-Suruga Tunnel. In regard to the Yokosuka Line, and its adjoining track. A passenger train stopping there was swept into the sea following a landslip on a neighbouring hill. Serious damage was also done between Nebukawa and Manazuru. On the Boshyu Peninsula line girders were completely consumed by fire on the bridge between Ryogokubashi and Kinshicho, and there was much cracking of the road bed between Kinshicho and Kameido. The sections between Inage and Naruto also suffered severely, as, too, did the section between Chiba and Emi. The Nanuya Tunnel was also badly knocked about. Sinking and cracking of the track



SHIRAITOGAWA BRIDGE, ATAMI LINE.

the following details have been notified: falling of earth and sand at the entrances of many tunnels, falling of embankments, cracking of road beds, collapsing and bending of bridges, whilst on the Yokohama Line there was considerable dislocation of track and falling on the rails of earth and sand.

On the Atami Line the damage was specially severe. Practically all traces of the track between Kozu and Odawara disappeared. One span of 150 ft. of the Sakawa River Bridge entirely collapsed. Much damage was done south of Hayakawa station and the Nebukawa station building between Nippori and Toride took place on the Joban line, and the Tonegawa river bridge cracked and shifted. Ueno station, on the Tohoku main line, was burned, the piers of the Arakawa river bridge cracking and sinking.

On the Chuo Line much damage was done to the road bed between Tokyo and Shinjuku. Cuttings and road beds near Ochanomizu collapsed in such a way as to dam up the Kandagawa. Some 200 ft. of the Yose Tunnel, between Yose and Uenohara, fell, and the track near Sasago was seriously damaged. Besides this, there was much cracking and falling of

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embankments and the burning of many buildings. The Atami Line (under construction) did not escape. Yugawara station and the employees' official dwellings in the 7th district were damaged, as, too, were Chitosegawa Bridge, various cuttings and embankments of the main line, the tunnels at Kinegoshi and Izusan, and Kishidani Bridge.

Serious damage necessitating much repair was sustained on the following sections of the electrified lines: between Ueno and Uguisudani, between Tokyo and Hamamatsucho, between Tokyo and Iidamachi, between Yokohama and Sakuragicho. No fewer than 33 locomotives were rendered inoperative, whilst 486 passenger cars, 1,249 freight cars, and 31 electric cars were more or less seriously damaged.

The following trains were injured either by fire or derailment with casualties: six passenger trains, with 129 persons killed and 90 injured, including both passengers and employees; six freight trains, with one person killed and two injured. Railway employees to the number of 73 were killed and 22 injured, whilst those whose houses were burnt or otherwise damaged total 10,018. The total loss to the State Railways is estimated at 75 millions of yen.

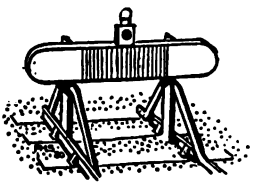
It speaks well for the level-headedness of the Japanese railway staff and their methods of organisation that operation of certain sections of the Chuo and Tohoku lines, in the neighbourhood of Tokyo and Yokohama, was resumed on the third day after the disaster, that is, September 3.

According to a recent *Times* report, it is now possible to run through trains between those two cities, and daily services have been resumed. To Tokyo travelling is painfully slow. There is reason for this, since many temporary bridges have to be crossed, and the way in several places is by no means permanent. Between Yokohama and Numadzu nearly all the bridges were destroyed. It was here that such excellent work was done by the Engineers Corps of the Japanese Army, work at least as valuable as any done in war. The bridges were modern structures of steel, carrying the railway line across gorges and over many rivers. In some cases they lie now in heaps of useless junk, fretting the water; in others, they have collapsed, more or less solidly, as if a weighty hand had pressed them down. Here and there the railway lines, with sleepers attached, hang festooned between the near and further banks.

Temporary bridges have been built to take the place of these broken structures. They have been constructed of railway sleepers and beams of wood, bolted together. The train goes gingerly over these, while planks and trusses groan and grumble, and a great trembling seizes the entire framework. The wheels of the train grind against the metals, and the nervous foreigner becomes alarmed.

In addition to the destruction of bridges, the earthquake caused much damage to tunnels, and here, again, the Engineers Corps have done valuable repair work. In many cases the brick lining of the tunnels was cracked, necessitating laborious reconditioning work. Lately there have been torrential rains, causing landslides on the line, greatly delaying traffic.

Temporary embankments have been thrown up in places where subsidences took place, and in the cuttings the banks have been heavily timbered. Altogether some 50 miles of track have been reconditioned. The damage was greater south of Yokohama than between that port and Tokyo.



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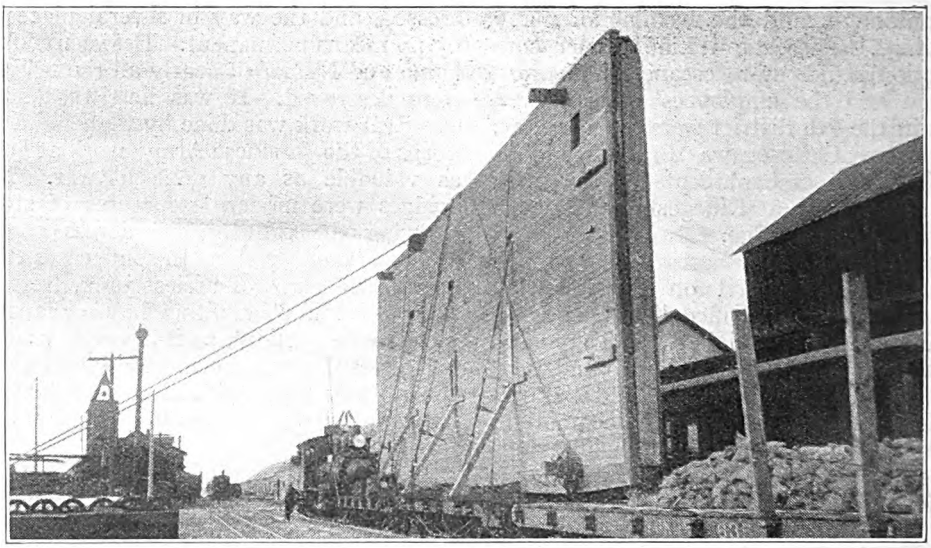

READY FOR TRANSIT.

A "Lofty" Railway Load.

THE construction of a dam across the Marsh and Tagish Lakes in the Yukon district of Far North-West America necessitated the conveyance of a big barge or float by railway, loaded to a height of 25 ft. above rail level, and in a position that would have been impossible in this country; and by courtesy of Mr. J. A. Robertson, Secretary of the White Pass and Yukon Railway Company (London), and of Mr. W. D. Gordon, Superintendent of the River Division, Alaska, we are able to describe this achievement and to reproduce several remarkable views.

The barge was the property of the White Pass and Yukon Railway, which is building a dam on Marsh Lake for water conservation purposes. During the winter the surplus water flows away, so that in the summer there is not sufficient water in the lakes to allow the railway company to run its boat services. The railway, therefore, decided to build a dam so as to impound sufficient water to make the lakes navigable in the summer. Material for constructing the dam was collected at Carcross, on Marsh Lake, and the barge was required there to transport the material to the site of the dam.

This barge measured 60 ft. long by 21 ft. beam, and was 3 ft. 6 in. in depth with a weight of about 20 tons. The railway journey of 43 miles was made over the White Pass and Yukon Railway, which has a gauge of only 3 ft. The narrow gauge of the line and the constricted cuttings through which the railway passes, precluded the conveyance of the load flat on the trucks. Fortunately, there are no overbridges or tunnels on the section of line over which the barge was to be conveyed; it was therefore possible to consider its transport on one of the sides. The depth of the barge being 3 ft. 6 in., necessitated the bottom of the load being above the wheels of the carrying trucks. The height of the load (*i.e.*, the beam of the barge) was 21 ft., which resulted in the top being some 25 ft. above rail level.

To transport so lofty a load was under any circumstances a difficult problem, but the 3-ft. gauge of the White Pass and Yukon Railway made the task even more embarrassing. This difficulty was overcome by placing along the side of the barge

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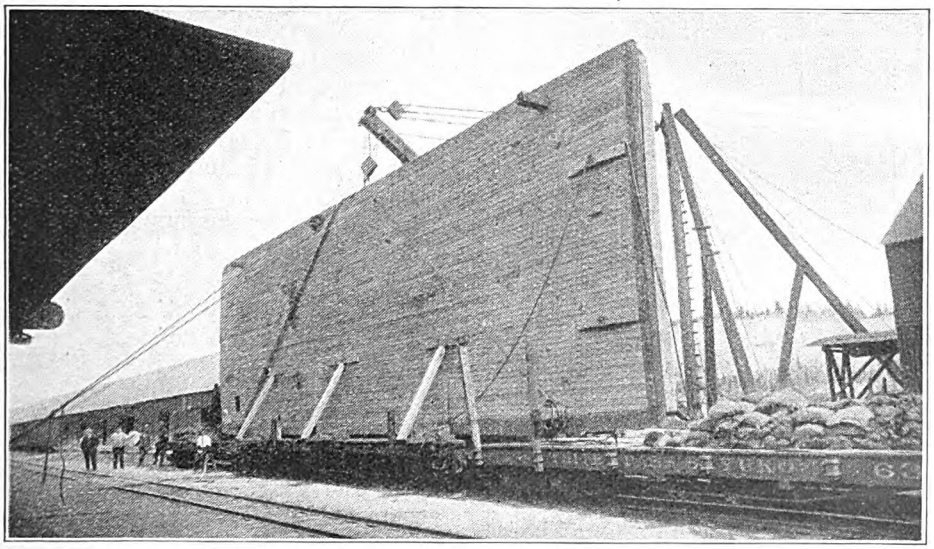
that was on the truck and was during the journey the bottom, four tons of silver ore; it so happened that a quantity of silver ore was at Whitehorse on the Yukon River awaiting transport to the coast. This weight gave a degree of stability to the load and prevented any great rocking, or tendency to topple over. The same principle was applied to the truck on which the barge was loaded and the two guard trucks, which, unloaded, were likely to turn over on their sides, should the load lose its perpendicular position.

A bogie well-truck was chosen to carry the barge; in the well was loaded 8½ tons of the silver ore, which weight, being just above rail level, added further stability to the moving load. A bogie flat truck was placed at each end of the carrying truck as runners to take the overhang of the 60-ft. barge. More of the silver ore was loaded on the guard trucks, so that there was considerable weight at a small height above rail level, whilst the weight of the barge itself was comparatively light per foot of exposed surface.

The barge was lifted out of the river dock at Whitehorse by means of a derrick, which also assisted materially in manœuvring the barge on to its side on the quay, and also in placing it on the well-truck. The barge, having been placed successfully in the required position on the truck, and loaded with silver ore ballast, was secured to the car by means of timber and wire ropes, as shown in the illustration on page 210.

The train of three cars, with its lofty load, was now considered safe to make the journey, and given absence of wind, which would have overturned the load, safe transport was anticipated. High winds are infrequent at night in the Yukon, and, therefore, it was decided that the journey should be made at night. After the barge was loaded, and until the train was about to depart, the load was secured to the ground by means of wire stays from the top of the barge, the other ends of the stay wires being fastened to the ground. Advantage was, therefore, taken of a windless evening to despatch the barge on its 43 miles rail journey. The train left Whitehorse at 8 p.m. and arrived safely at its destination, Carcross, at 6.5 a.m. the next morning. The average speed of the train, therefore, was 4·3 miles an hour.



PLACING IN POSITION.

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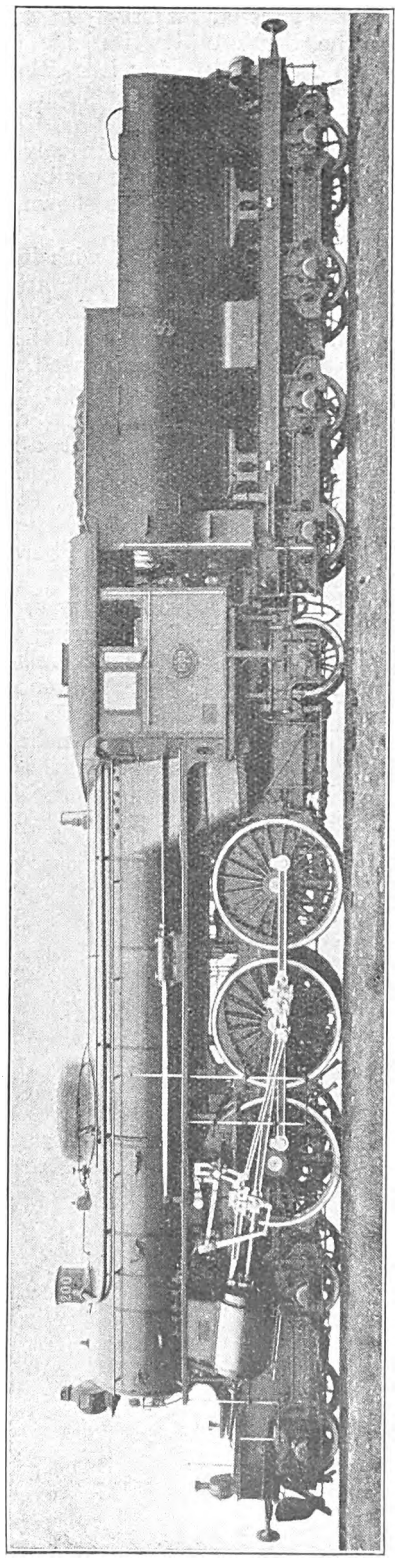

4-6-0 LOCOMOTIVES, SWEDISH STATE RAILWAYS.

AMONG the many remarkable locomotives in use on Continental railways, engines of the class illustrated, by courtesy of Mr. Harold M. Briggs, of Göteborg, take a leading place. Known as type F, these engines work between Stockholm and Malmö, taking loads up to 500 tons at an average speed of 36 m.p.h. They are expected to maintain an average of 24 m.p.h. on long banks of 1 in 100, with maximum loads, and with the more usual weight of 400 tons to maintain 30 m.p.h. on such banks. In estimating the value of the work they perform, it is necessary to take into account, as Mr. Briggs points out, that except for 10 or 12 miles out of Stockholm the route is entirely single track and there are frequent slacks at crossing stations or for other reasons, so that much better work than the speeds mentioned appear to indicate is actually entailed.

The engines are four-cylinder compounds, with low-pressure cylinders outside, and have large, wide firebox boilers. The axles of bogie and tender wheels are fitted with Skefko ball bearings. The class made its first appearance in 1915, though one of the later examples is illustrated.

Leading dimensions are :—

Cylinders (h.p.)	16⅞ in. by 26⅝ in.
Cylinders (l.p.)	25⅝ in. by 26⅝ in.
Coupled wheels	6 ft. 3 in. diam.
Steam pressure	180 lb. per sq. in.
Heating surface :—	
Tubes	1,906 sq. ft.
Firebox	133 sq. ft.
Superheater	732 sq. ft.
Total	2,771 sq. ft.
Grate area	39 sq. ft.
Adhesion weight	46 tons.
Engine weight in working order	84 tons.
Engine and tender weight in working order	52 tons.

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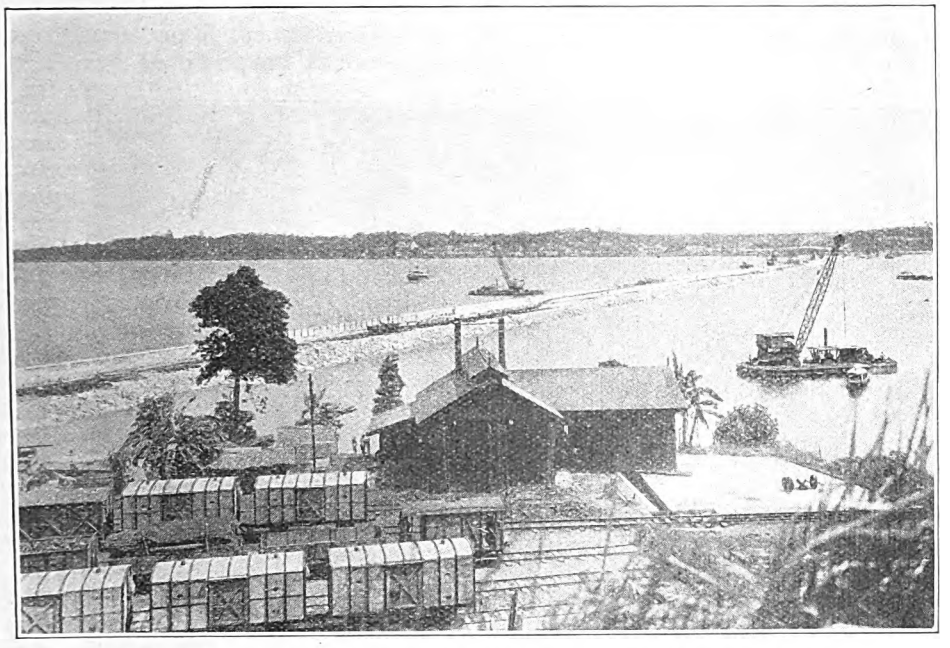

GENERAL VIEW OF NEW JOHORE CAUSEWAY FROM SINGAPORE SIDE.

Railway Progress in the Federated Malay States.

RUBBER tyres were the chief factor in making motor transport successful: much rubber is produced in Malaya. To open up this country for rubber production, and to convey the commodity to the coast for shipment have necessitated the construction of a big system of railways in the Federated Malay States. It can, therefore, be claimed that the railways of Malaya have been constructed to assist in the world development of road transport.

The first section of railway, 8 miles long, was opened June 1, 1885. The latest returns show 966 route miles of line open, of which 56¾ miles were double track; 128½ miles are under construction, of which 73½ miles are new lines, the remainder being deviations and widenings. The lines are of metre gauge.

The place in the Malaya Peninsula most in the public eye is Singapore, at the south-eastern extremity. Singapore is on an island separated from the main peninsula by the Straits of Johore, and up to a few months ago connection was made by means of ferries. Now, however, the causeway across the Straits has been completed, and trains run through; the recent completion of railway extensions in the north of the peninsula has also effected a through railway connection with the State railways of Siam, and from January 2, 1922, a through train has been running weekly in each direction between Bangkok and Penang, a distance of about 706 miles. The continuation to Singapore makes the total rail distance between Bangkok and Singapore about 1,200 miles. The journey between Bangkok and Prai by the weekly train occupies 34 hours. From Prai to Singapore, including a change at Kuala Lampur, with a stop of about an hour, takes another 23 hours, so that the whole 1,200 miles is covered in 57 hours. The Siamese State railways have since May 1, 1922, run day and night coaches on the through trains.

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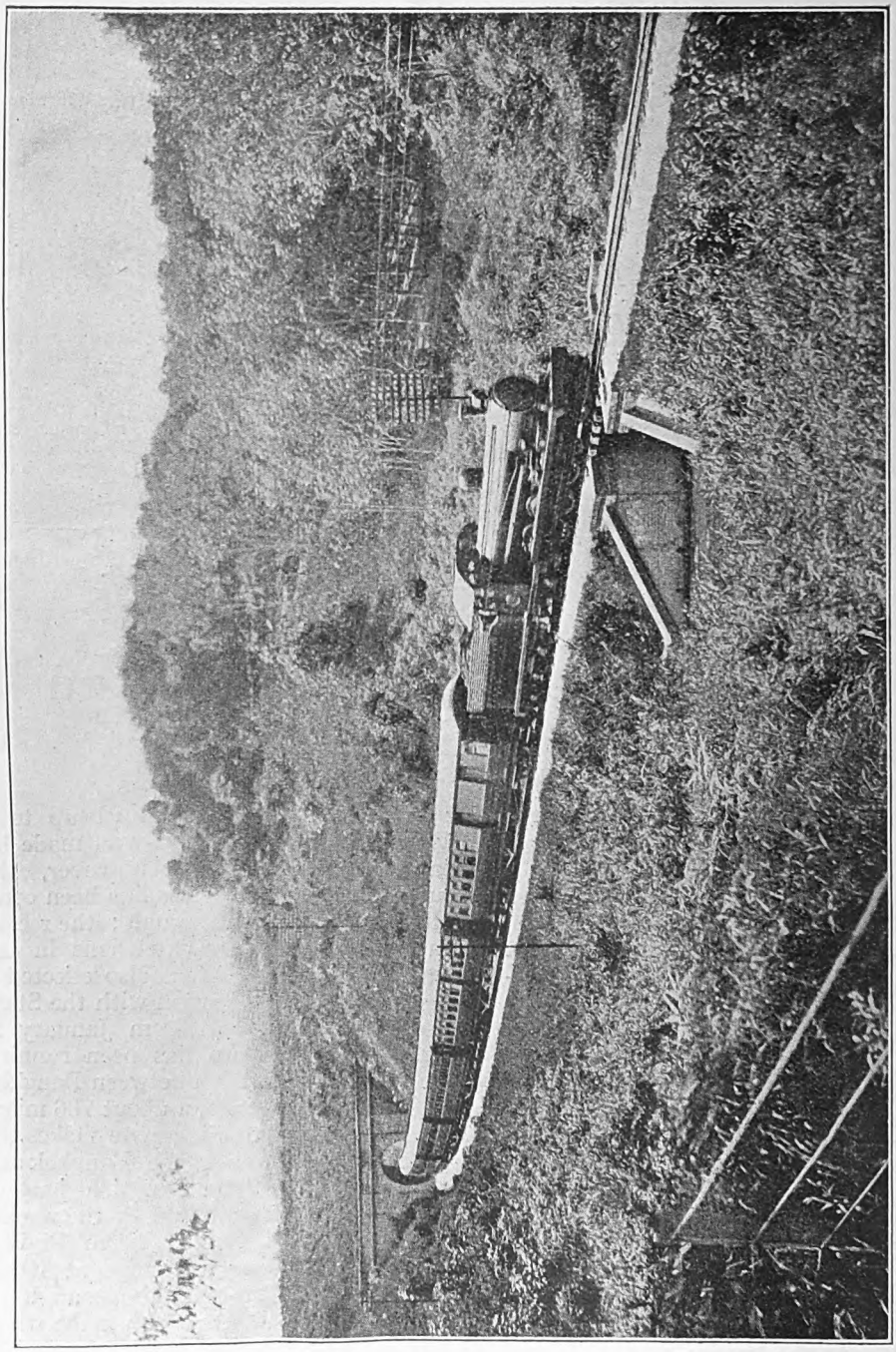

MAIN LINE TRAIN (CONSISTING OF NEW ROLLING STOCK) APPROACHING SEREMBAN, FEDERATED MALAY STATES RAILWAYS.

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The construction of the causeway from Johore Bharu to Singapore Island occupied four years. Although described as a causeway, water communication through the Strait of Johore has been provided for. The causeway is deviated by a lock at the Johore end. The lock is 170 ft. long and 32 ft. wide at the gates; within the lock the width is 45 ft. Double lock gates have been provided, because at the change of tide, the direction of the flow of water is reversed. The railway and roadway are carried across the lock by an electrically operated lifting bridge. The moving portion weighs 570 tons. Over 1,500,000 cubic yards of stone have been used for the construction of the causeway, which cost almost £2,000,000. Previous to the war, it was proposed to construct a bridge across the strait, and a considerable sum was spent on surveys, trial borings for the piers, &c., but, as the depth of water at low tide varied between 46 ft. and 70 ft., the idea of a bridge was abandoned and the causeway substituted. The total length of the causeway is 3,500 ft. The material to form it was mostly conveyed by railway from quarries a few miles distant. The construction of the causeway will render unnecessary the railway wagon ferry across the strait. During 1922, 21,166 loaded and 4,952 empty wagons were conveyed to Singapore, whilst 21,632 loaded and 4,270 unloaded wagons were ferried in the opposite direction. The ferry steamers made 11,007 trips to transport these 52,020 railway wagons.

A short extension, but to Europeans a most important addition, is the Penang Hill Railway, 1¼ miles long, opened October 21, 1923. By means of this railway, which is cable operated, the Penang Hills, having an altitude of 3,000 ft., are easily reached from Penang. The railway rises 2,270 ft. Two cars are employed, one at each end of a cable, twice the length of the railway. At the summit the cable passes over a drum, so that the descending car helps to pull up the car from the bottom. The average gradient is 1 in 3, but on a portion of the upper section of the line it is as steep as 1 in 1·93, and on the lower 1·98. The track is single, except at the passing place. Special automatic and other brakes are fitted: the former come into operation should any mishap occur to the cable. Goods are loaded in a truck which, by means of a crane, is lifted on to the line in front of the passenger coach going up, and behind it coming down, the coach always being the first vehicle descending and the last going up. Passengers are not conveyed when the goods wagon is making a trip. Electricity is employed to assist in turning the cable drum.

Other important recent developments on the Federated Malay States railways include the inauguration of telephonic train control on the line between Tanjong Malim and Sungei Gadut, with a control office at Kuala Lumpur, connected by telephone with all stations in the control area. War conditions have caused fares to be increased considerably, with the result that road motors attracted much of the traffic from the railway. This was particularly the case in the district served by the Tronoh branch. To counteract this motor competition, the second and third-class fares have been reduced a cent a mile, and the railway has in consequence regained the passenger traffic to a considerable degree.

Recent developments with regard to locomotive stock include the withdrawal of eight 0–4–2 tender engines in 1922, and the addition of ten 2–6–0 tender engines. These were the first engines of this type on the railways. The other tender engines at the end of 1922 were 4–4–0 (18), 4–6–0 (42), 4–6–2 (112) and 0–6–6–0 (2), total 184. The tank engines were 0–6–0 (11), 0–6–4 (31), 4–4–0 (25), and 4–4–2 (2), total 69. There were also four steam rail motors. Twenty bogie coaches were built at the railway works, in 1922, viz.: two sleepers, three buffet cars, four first and second composites, and five third-class carriages, and six third-class and brake vans. These brought the total of bogie carriages up to 435; in addition to which there were 27 four-wheel coaches. The total of coaching vehicles, including vans, horse boxes, &c., was 611.

In many districts the railway runs through dense jungle and wild elephants occasionally attack the stations and do considerable damage. Natives also have a habit of cutting the telegraph and telephone wires. Special means are employed to detect these cases, and when a culprit is caught the punishment is drastic.

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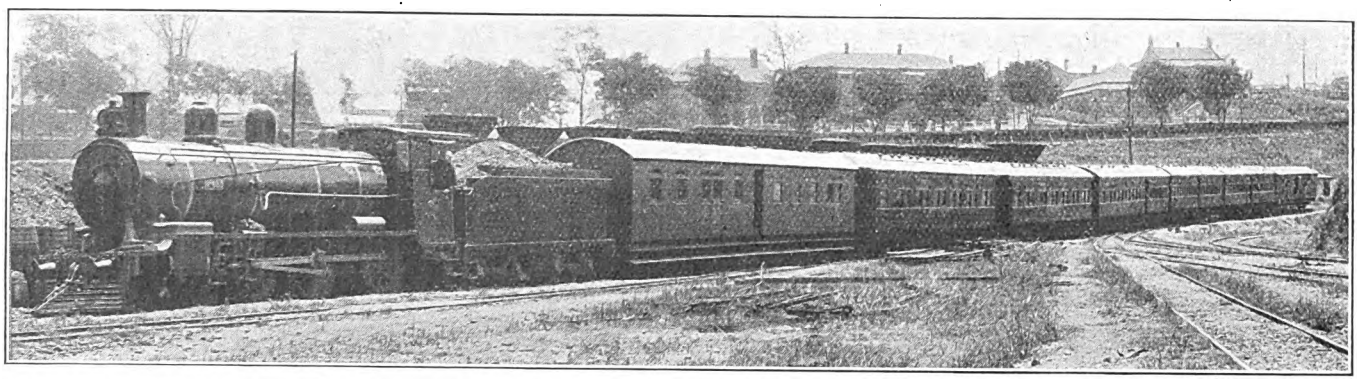
NEW MAIL TRAINS, BRISBANE-TOWNSVILLE SERVICE, QUEENSLAND GOVERNMENT RAILWAYS.



IN anticipation of increased passenger and mail traffic as a result of the completion of the construction of the railway to Mackay and Townsville, and eventually to Cairns, the Queensland Government Railways have recently built three complete trains for this service. Two trains will at first be engaged in regular service and the other train will be held as a reserve for abnormal traffic requirements or for replacement in case of overhauls, &c., but eventually all three will be required. Each train consists of eight vehicles: two first-class Pullman sleepers, two second-class sleepers, one composite sleeper, one post-office car, one mail and luggage van, and one guard's brake van. With the exception of the Commonwealth Railway service between Port Augusta and Kalgoorlie, Queensland is the only Australian State to provide sleeping cars for second-class passengers; in fact, Queensland was one of the first countries in the world to adopt this practice. Second-class sleeping cars have been in service in Queensland for some years past and are much appreciated by the travelling public.

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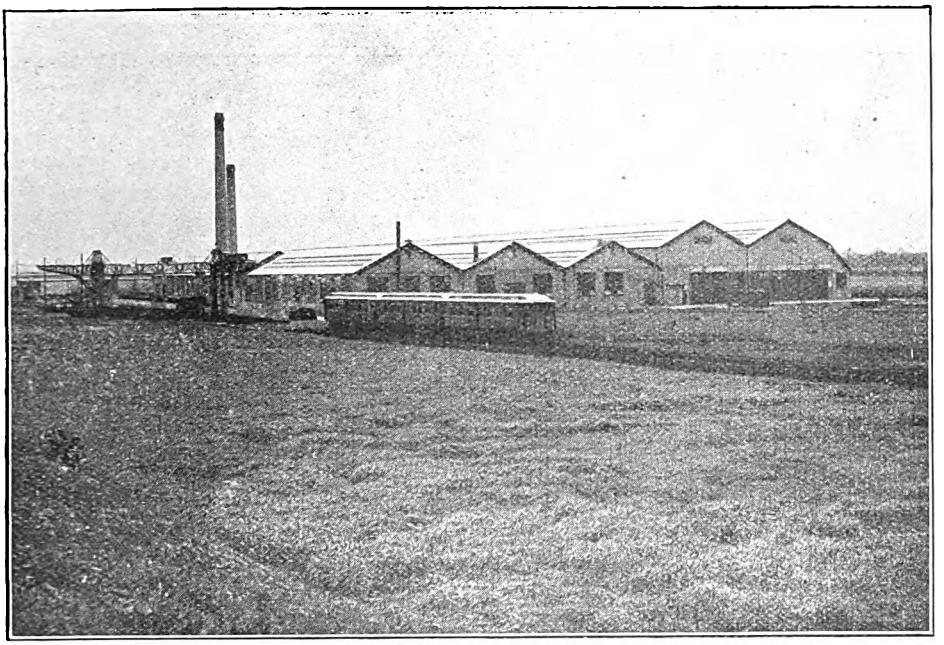

GENERAL VIEW OF WORKS

New "Underground" Rolling Stock Overhaul Works at Acton.

IN December, 1920, it was decided to provide a central workshop for the overhauling of the rolling stock of the Metropolitan District, London Electric and City & South London and Central London Railways, the existing repair shops originally built by each of the companies being inadequate to maintain the rolling stock, owing to the increase in the number of cars and car mileage which had taken place since their repair shops were first provided.

About 30 acres of land were purchased near Acton Town station, and the first portion of the new works was completed and brought into use in December, 1922, sufficient equipment being provided to undertake the periodic overhaul of the District, Bakerloo, Piccadilly, and Watford Joint Stock. Later it is intended to extend the workshop to permit of the overhaul of Central London, Hampstead, and City & South London rolling stock and the concentration of all car painting and body-repair work, together with the repair and manufacture of engineering stores and supplies required in the mechanical departments of the allied railways. Additional land is being obtained for such extensions. About 500 men are employed at the present time, and the shops are now overhauling 16 cars a week, which nearly covers the needs of the District, Piccadilly and Bakerloo lines, also undertaking the stores manufacturing work for the outlying depots.

Careful consideration was given at the outset to the various systems of operating an overhaul shop, and it was decided to give a trial to a " progressive system " in which each vehicle moves forward in stages until the overhaul is completed. In automobile works, where the progressive system is largely used, progression is obtained by means of travelling platforms, but railway cars are too large and heavy to allow such platforms to be used economically. Special bogies, called " accommodation bogies," were therefore designed on which the car bodies are placed after withdrawal of the service bogies, the car body thus remaining

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mobile, and being moved from stage to stage by means of electric traversers and capstans.

Plans for part of Stage 1 of the new workshops were completed and building was commenced in December, 1921, the shop being completed and the actual work of car overhaul commenced in December, 1922. The main shop consists of one building 400 ft. long by 250 ft. wide, and is divided into four main sections :—

(1) Truck Section.
(2) Car Body and Electrical Equipment Section.
(3) Smithy and Wheel and Axle Section.
(4) Machine and Fitting Section.

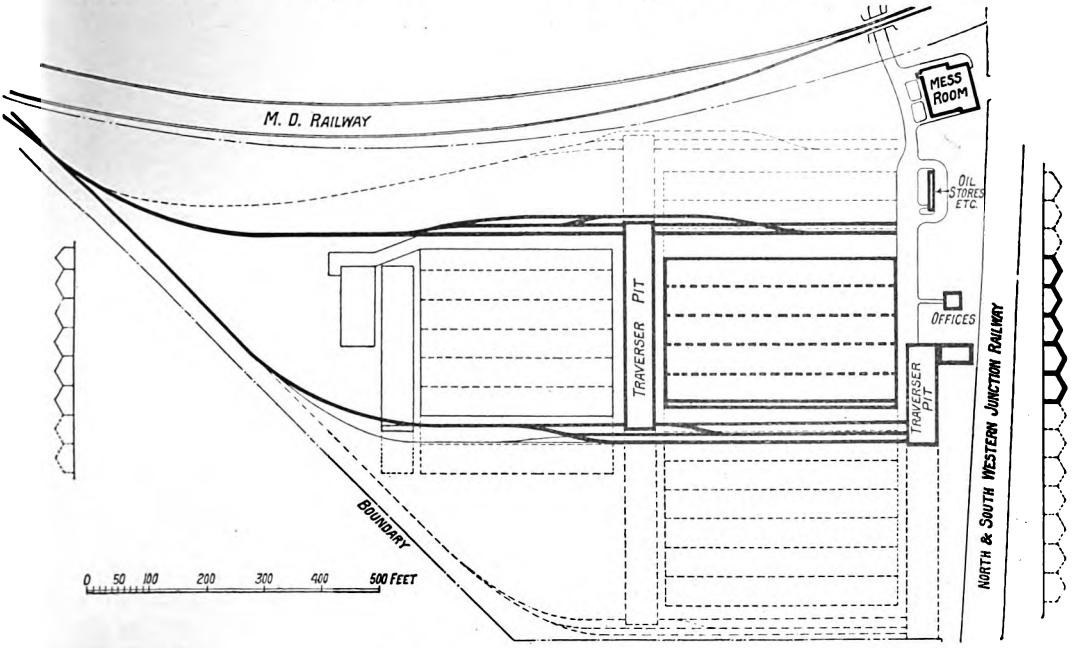
Truck Department.

This department is divided into three sections :—

(1) Dismantling Section,
(2) Frame Repair Section,
(3) Assembly Section,

and occupies one main bay, 400 by 50 ft. wide, served by two overhead travelling electric cranes, each of 15 tons capacity.

Cars for overhaul pass from the inward sidings to the Dismantling Section by means of a 45-ton electric traverser. They are moved from the traverser to dismantling pits, situated at one end of the truck bay, by means of an electric capstan.



GENERAL PLAN OF SHOPS.

Showing also projected extensions.

The plan shows in heavy full lines the shop as now existing. Proposed extension of Sections 1 and 2 are shown in dotted lines. A further proposed extension comprising wood-working, body, and paint shops is shown in thin full lines. An armature-winding shop will be included in the area allocated for extension of Sections 1 and 2. The total covered area of the shops when completed will be 10 acres. The area of works and yards is 28·43 acres. It is estimated that Stage 1 would be sufficient to deal with 30 cars per week, and Stage 2 with 60 cars per week.

After the trucks have been disconnected from the car body, the latter being lifted by means of the two overhead cranes, the bogies are withdrawn towards the Truck Dismantling Section. The body is then lowered on to two accommodation bogies and is drawn out again on to the electric traverser by means of the capstan, for transfer to the Car Body Department. The bogies are next dismantled by means of the overhead cranes, the various parts passed through the washing tanks (a special washing machine with travelling chain floor is being provided to replace these

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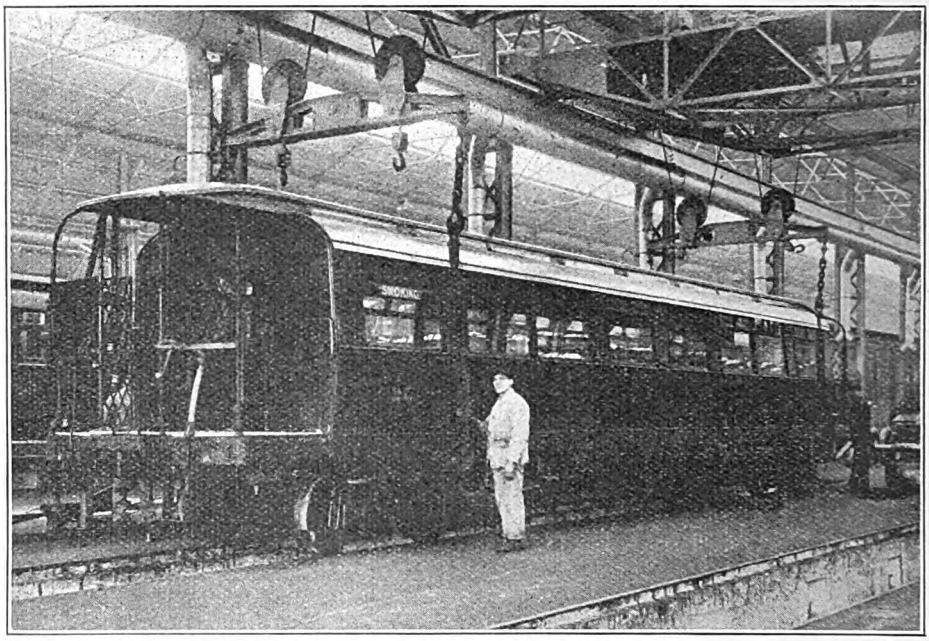

FOUR POINT LIFTING GEAR.
Designed by "Underground" staff.

tanks), and the parts are then passed to the particular department or section which executes the necessary repairs to them.

The motors are transferred complete by means of electric battery trucks to the Motor Section for overhaul. The truck frame, after cleaning, is conveyed by the overhead cranes to one of 35 stances provided in the Frame Repair Section. On these stances any necessary repairs to the frame are carried out, and the reassembling of the various parts, such as axle-boxes, brake gear, &c., is carried out. At the other end of the truck bay is the Assembly Section, comprising six stances for assembling truck frames on to the axles and the putting in of the motors, also two assembly pits on which the car body is replaced on the running bogies and the accommodation bogies withdrawn. The process here is the reverse of that carried out on the dismantling pits, the overhead frames being used for lifting, and an electric traverser, which is a duplicate of the one used at the inwards end of the shop, being used to transfer the car body from the Body Department to the Truck Department. After the car is lowered on to its bogies the accommodation bogies pass out on to the traverser, and proceed by means of a track outside to storage sidings at the inwards end of the shop ready for use again on other cars.

After the car has been lowered on to its own bogies and checked to ensure that it is right for height of springs, &c., it is passed out of the shop across the traverser to the Inspection and Finishing Shop. This is provided with two tracks and two pits. Here the current-collecting gear is erected, and electric and brake connections made and tested. This special accommodation has been provided in order to relieve the valuable space provided with lifting facilities in the truck bay. After testing, the car is again passed on to the electric traverser, which conveys it to outside sidings from which it leaves the works.

Car Body and Electrical Equipment Department.

This department consists of five sections :—

(1) Body Section.
(2) Motor Section.
(3) Electrical Equipment Section.
(4) Compressor Section.
(5) Brake Section.

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The Body Section occupies a bay 400 by 50 ft., provided with three through tracks, each track accommodating seven cars. Two tracks are set apart for motor-cars and one for trailer cars. This allows the trailer cars, which require a shorter time for overhaul, to pass through the shop at a quicker rate than the motor-cars. The cars enter from the electric traverser at one end and pass through the Body Section by four stages. The car being on accommodation bogies which carry it at a convenient height to facilitate the necessary dismantling and assembly of electrical equipment, compressors, &c., also any necessary repairs to the under-frame, is moved forward in stages through the Body Section by means of electric capstans. The time taken for a car to pass through this section is six days in the case of a motor-car and four days in the case of a trailer-car. The work done on the various stages is as follows :—

Motor-Cars.

Stage 1	..	High tension testing, stripping control equipment and compressor.
Stage 2	..	Overhauling electrical fixtures and making good defects found during high-tension testing.
Stage 3	..	Re-fit compressor, contactors, final adjustments, and test control.
Stage 4	..	Inspection and insulation tests.

Trailer Cars.

Stage 1	..	High-tension testing, inspection of bus lines and connection boxes.
Stage 2	..	Overhauling switch panels, making good defects found during high-tension testing.
Stage 3	..	Overhauling heating and lighting circuits.
Stage 4	..	Inspection and insulation tests.

The overhaul of the body structure, fittings, &c., is carried out during the progress of the car through the various stages. On arrival at the exit end of this section, the car passes on to the electric traverser, by means of which it is then passed to the Assembly Section of the Truck Department.

The Motor Section comprises four areas :—

(1) Motor Dismantling Area.
(2) Armature Repairing Area.
(3) Field Coil and Motor Case Area.
(4) Motor Assembly Area.

Complete motors are brought from the Truck Department to the Motor Dismantling Area by means of electric battery

GENERAL VIEW OF TRUCK BAY.

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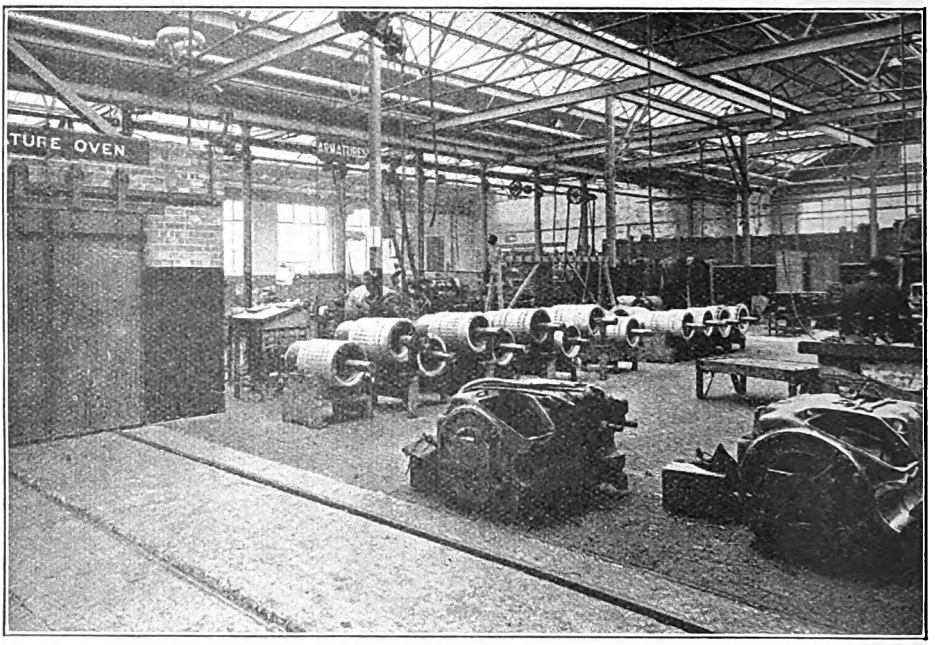

ARMATURE WINDING SHOP.

trucks. They are then dismantled under a 3-ton electric jib crane of 20 ft. radius. A blow-out plant within the radius of this crane is provided to blow out the dust from the armature and motor case. Compressed air is used for this purpose, and an exhaust fan, driven by a 20-h.p. electric motor, draws the dust into a special tank, provided with water baffles, where it is deposited. The armature is then passed to the Armature Repair Shop, which is provided with an overhead runway with compressed-air hoists to facilitate the movement of the armature to the various machines and stands where the repairs are carried out. Special machines are provided in this section for commutator turning, keyway-cutting, commutator slotting and armature binding, also stands for winding, enamelling, &c.

These machines and stands are placed in the order in which the operations are carried out, the armature passing in rotation to each machine or stand, and finally being placed on a truck (accommodating seven armatures) on which it is passed through a stoving oven. After stoving, this truck leaves the oven at the opposite end and comes under a second 3-ton electric jib crane of 16 ft. radius, which serves the Motor Assembly Area, where it is tested before assembly in the case. In the meantime the motor case and field coils have been repaired in the area set apart for that purpose. Two radial drills are placed within the radius of one of the jib cranes to enable stud-holes to motor cases to be drilled and tapped. The motor is next assembled and is conveyed by electric battery trucks to the Assembly Section of the Truck Department. Stillages are used to facilitate the handling of both motor cases and armatures. It is intended finally to combine this section with the new Armature and Field Coil Winding Shop.

The Electrical Equipment Section is provided with fitters' benches for overhauling electrical equipment brought to the section by means of transveyor trucks and stillages. The different unit parts are dealt with on benches specially allocated for the work, and the equipment is transferred from and to the sections as complete car sets.

The Compressor Section is provided with three special stands over which an overhead runway with hoists is provided to facilitate dismantling and assembly of the compressors. The compressors are transferred

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to and from the section by means of transveyor trucks and stillages. Compressor armatures and field coils are sent to the Motor Section to be dealt with. All compressors are given a running test under working conditions before dispatch to the Body Section for mounting on the underframe.

The Brake Section is provided with fitters' benches for the overhaul of cylinders, black adjusters, drivers' brake valves, triple valves, cocks, &c., and a test bench is provided where the complete equipment is tested under normal conditions before being passed to the Body Section for mounting in the cars.

Smithy and Wheel and Axle Department.

This is divided into two sections :—

(1) Smiths' Section.
(2) Wheel and Axle Section.

The Smiths' Section occupies an area to the north end of the Machine Shop and is fully equipped for carrying out repairs to brake gear, bogie parts, springs, &c. An electrical welding area is attached to the smiths' shop. Building up of worn parts is also undertaken in this area. Provision is also made in this area for thermit-welding certain parts which cannot be dealt with by the electric plant.

Wheel and Axle Section.

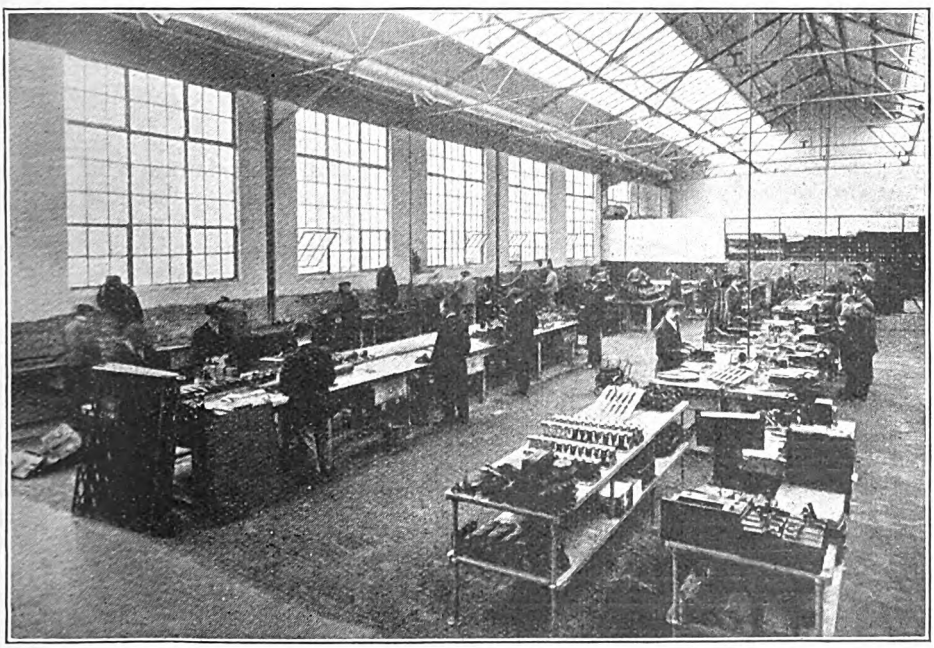
(1) Tyre and Axle Area.
(2) Wheel-turning Area.
(3) Bearing Area.

The Tyre and Axle Area contains equipment of the most modern description. Two motor-driven hydraulic presses, each of 200 tons capacity, served by a 35-cwt. electric jib crane, are provided for pressing wheel centres and gear wheels on to the axles. The tyre mills are fed by three special compressed-air cranes designed and built at Acton. The bored tyres are expanded in two electric induction heaters and then shrunk on to the wheel centres, a 35-cwt. electric jib crane being provided for lifting purposes. The Wheel-turning Area contains four wheel lathes each driven by an independent electric motor. The Bearing Area is equipped for the general overhaul and re-metalling of axle-journal bearings, armature bearings, and motor-suspension bearings.

The Machine and Fitting Department.

(1) Machine Section.
(2) Fitting Section.

The Machine Section is well equipped with machine tools of various types. As



GENERAL VIEW OF ELECTRICAL FITTING SHOP.

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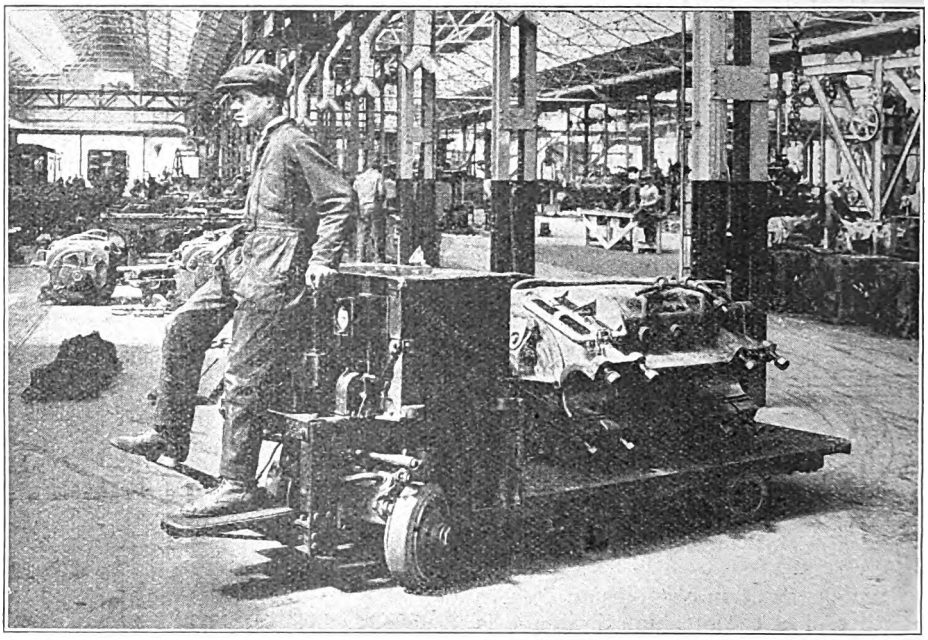

ELECTRIC BATTERY TRUCK CARRYING COMPLETE MOTOR.

far as possible all machine work is carried out on stores manufacturing orders, thus enabling large quantities of particular articles to be dealt with at the same time. A tool-room is attached to this section, and is equipped to provide tools for the whole of the machines used in the works. The Fitting Section is equipped with benches on which unit parts are fitted up for use in the truck and car body departments, stillages and transveyor trucks being used to transport the unit parts to and from the truck and car body departments.

A special feature has been made of the heating and ventilating of the works. A canteen is provided for the use of the employees, seating accommodation being provided for 400 men. A varied menu is provided; a three-course dinner can be obtained at a cost of 1s. Arrangements are also made to cook meals for those who prefer to bring their own food with them.

The stores are situated inside the works. A system of loose containers is used for storage of raw materials and spare parts. Heavy materials, such as steel tyres, castings, &c., are stored in concrete dumps outside the works. A 3-ton electric gantry crane serves these dumps, as also the wheel park and scrap dumps. Materials can be loaded to or from road or rail by means of this crane.

Auxiliary buildings, comprising administrative offices, oil, petrol, carbide, stores and waste stores, ambulance room, cycle shed for 100 machines, and spare parts stores, are provided.

Alternating current is provided for lighting and for certain special purposes, such as tyre-heating, rivet-heating, pipe-bending, &c., and is obtained from the L.G.O.C. transformer house at Chiswick works. Direct current is provided from Acton Town sub-station, a special main being laid from the sub-station to the works switch room. Provision has also been made in case of necessity for switching over on to the yard tracks.

Special attention is being given to the question of lighting, the idea being to obtain a good general light rather than have a number of local lights. Certain machines are provided with local lights, as are also a certain number of benches where the work is of a more delicate nature.

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RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, *33, Tothill Street, Westminster, London, S.W.1. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition* (1924) *of this standard railway reference work is in preparation and will be published in April next.*

Passenger and Goods Locomotive Liveries.

It is somewhat to be regretted that the tendency is to adopt a plain black livery for goods and shunting locomotives. It is due, however, mainly to the comparatively rough conditions under which these engines often do their work, and the fact that, except as seen in a general way, they do not come so much under the notice of passengers as do the express engines. We certainly do not agree that the passenger locomotives are "out of sight of passengers" owing to their necessary position at the head of a train. On the contrary, the engine is frequently a centre of interest, and as a train is viewed while travelling, is necessarily the first part of the train to attract attention. On the London and North Eastern Railway, although goods and tank engines are painted black, the livery is neat and attractive. We cannot, of course, go into the question as to why the liveries of one grouped company were adopted in preference to those of another equally concerned.

[Reply to H. E. THORPE and D. V. MARSHALL.]

Catch-Points.

Seeing that the whole object of a pair of catch-points, or trap points, is to throw a train off the line in the emergency which they are designed to meet, it stands to reason that they must be "turned the wrong way," to use your expression. In the photograph you send of Wickford station, on the Great Eastern Section of the London and North Eastern Railway, the trap points in the foreground are intended to derail any train which might, by a misunderstanding, begin to draw out of the dock platform on to the up main line when the latter had been cleared for an up train, and so to prevent a much worse accident. Normally, of course, no such misunderstanding ever occurs, and the trap points simply exist as a safeguard. When a train is signalled out of the dock platform, the points must be closed before the appropriate signal can be pulled off, and, conversely, before the main line can be signalled, the points must be opened, these movements being controlled by the locking in the signal-box.

[Reply to C. V. BURNS.]

Great Ponton and Waltham-on-the-Wolds.

We are officially informed as follows:—The present position with regard to the line under construction between Great Ponton and Waltham-on-the-Wolds, is that a line already exists from Highdyke Junction (near Great Ponton) to Stainby,

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on which the following depots are situated : Burton Lane, Colsterworth and Stainby. The Frodingham Iron and Steel Company have a siding between Colsterworth and Stainby and a branch line is in course of construction from this point to Sproxton in the Waltham direction, the total length being about three miles, for the purpose of serving the Parkgate Iron Company's mines. There is no intention at present to extend the line to Waltham-on-the-Wold, and there will be no passenger station on the branch. There is no proposal under consideration for the construction of a curve at Scalford for the purpose of giving direct access between Grantham and Melton Mowbray.

[Reply to R. T. NINNIS.]

Time Table Alterations.

The cutting you send from the *Morning Post* to the effect that some time ago an effort was made to reduce the running of a London to Bournemouth train by six minutes and that it was found the change affected the running of six hundred others, one as far north as Manchester, is substantially correct, though not expressed so as to accord entirely with the facts. The point is that the altered times at junctions and connecting points in the case of an accelerated train may require the times of many other trains to be altered, these reacting at their own junctions and connecting points upon still others. Hence, in the case of a train whose movements are associated with those of others, it may be necessary to take into account the effect of the alteration on trains very far afield. In the instance mentioned, the suggested alteration of a London-Bournemouth train would, apparently, affect the running of certain through trains, such as the Manchester and Bradford-Bournemouth services.

[Reply to E. E. ALLENDER.]

Statistical and Calculated Information.

Your query does not conform with the rules, in that you give neither name nor address in authentication of your query, though not for publication. Moreover, your query is unjustified in that we cannot undertake to work out a number of calculations of tractive effort and horse-power, which you can easily do yourself after collecting the dimensions and other particulars required, all of which have been given in these pages, sometimes several times. If you do not wish to be referred to back numbers, the formulæ required can be obtained from works on locomotive engines, which is one reason why we are not prepared to repeat them every two or three months. All Great Western 2-8-0 locomotives have two cylinders only. In regard to your enquiries as to maximum speeds and other speed information, please refer to Mr. Allen's articles.

[Reply to " CONSOLIDATION MIXED TRAFFIC."]

Southern Railway Services.

Trains between Ashford and Margate (Sands) usually run first to Ramsgate (Town) and then reverse. Through trains run to Deal and Sandwich via Ashford ; also from Margate and Ramsgate, reversing at Minster Junction, but not from Faversham, as that would involve an unnecessary reversal at Dover, though one or two trains from Ashford have a reversal at Dover Marine. A local service runs between Ashford and Hastings. Some of the London trains are through or have through carriages to Bexhill via Tonbridge, but not, of course, via Ashford. Your suggestion is noted, though it relates to a matter which has many times received consideration in the past. It will, however, be borne in mind, and it is possible that we shall be able to devote a small amount of space on the lines you suggest, though not to any great extent.

[Reply to " OWENORA."]

Punctuality at a Great Terminus.

Notes under this heading supplied by Mr. C. V. Marsden, and referred to in " Pertinent Paragraphs," in the February number, have caused several readers to send in corresponding remarks in regard to arrivals at various large stations. Unfortunately, space will not permit of these being dealt with at length, except that they afford evidence of the general high standard of punctuality achieved by the principal lines, but we are obliged to readers who have written in this connection. You are correct in pointing out that the train due at Euston at 11.40 a.m. is really a stopping main line train and not an express, Northampton being merely one of the places served. Presumably, our correspondent included it as a main

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line service for completing the series which came under his observation.

[Reply to "VAUXHALL," "NORTHAMPTONIAN," and others.]

Banner Signals.

Presumably, you refer to the Sykes' electric banner signals used as repeaters on the late Great Eastern lines between Liverpool Street and Enfield and Chingford. These are not entirely confined to the down lines as you suggest. In fact, there are several on the up lines. Their purpose is to repeat signals under conditions where a stop signal is cleared after the true distant has been passed at "danger," so as to avoid the necessity for drivers reducing speed in cases where the need therefor, which applied when passing the distant signal, has been removed before the stop signals are reached. These signals are electrically operated.

[Reply to "SNOW HILL."]

London and North Western Compound Locomotives.

All the three-cylinder compound passenger locomotives, both 2-4-0 and 2-4-2, in each case with uncoupled driving wheels, have long since been scrapped. The names of most of these engines are, however, borne by locomotives of present-day classes. Presumably, in instances where on various railways no further engines have been built of classes consisting of one or a small number of locomotives, the explanation is that they have a limited field, that their purpose can sufficiently well be served by engines of other classes, or that the introduction of new designs has rendered it unnecessary to add to the classes in question.

[Reply to H. A. BRADBY.]

Somerset and Dorset Joint Railway.

Photograph reproduced on p. 102 of the February number was taken some time ago, when Somerset and Dorset Joint Railway 2-8-0 engines were being used for mineral traffic between Wellingborough and London. The Millbrook referred to is a box near Ampthill Tunnel on this route, and not that on the late London and South Western Railway, a point hardly likely to be reached by these engines, as you point out, as they are not allowed to work south of Templecombe. Your remark is noted that these are the only 2-8-0's fitted with brake blocks front and rear of the "pony" truck.

[Reply to G. CULLIS.]

Power Calculation.

Obviously where cylinder dimensions and steam pressure approximately correspond, the smaller diameter of coupled wheels of tank and goods engines will cause the tractive power to be greater than in the case of express passenger locomotives. Tractive power is, however, only one of several factors which govern locomotive performance. The *London and North Eastern* (*Great Eastern*) *Magazine* can be obtained at stations of the company or direct from Liverpool Street, and the associated *North Eastern Magazine* from York. Both are monthly staff publications.

[Reply to S. IRLAM.]

Express Services, late Great Eastern Railway.

You are correct in your supposition that a considerable acceleration of Great Eastern Railway main line services took place shortly after the commencement of the war. This speed-up followed the succession of Sir H. W. Thornton to the General Managership of the line, and was effective from October 4, 1914. Cambridge was reached from Liverpool Street in 70 min., as you state. Prior to that the best time from Liverpool Street had been 72 min., by the old 4.30 p.m. down, and 71 min. from St. Pancras, by the 12.20 p.m.

Great Western Railway Records.

Several record performances between Plymouth and Paddington have been referred to in our pages, including all those which have an historic importance. Unless you refer to one of which brief mention was made in the press when the 226 miles were run in 234 minutes, but of which we have no further details, kindly indicate what particular record you have in mind. We have no information as to whether further engines of the class mentioned are to be built at Swindon.

[Reply to "REDGAUNTLET" and "BALTIC."]

Locomotive Practice under Grouping.

It should be obvious that, whatever may be done in future practice, there

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would be no justification for incurring the expense of altering engines in order to standardise driving on the left or the right-hand side. Even on railways where one practice is adopted there are frequent instances of individual engines or classes arranged otherwise. No doubt, in due course, the shed numbering will be altered to cover the whole of a section or division, but this is one of the details which will be dealt with as opportunity demands. [Reply to A. V. B.]

Cylinder Cocks.

Your difficulty is not altogether clear, but from the description given we can only suppose that you refer to the cylinder cocks provided under all locomotive cylinders for the purpose of draining away condensed water. When the cocks are opened during the running of an engine—as is frequently the case on starting, or if the engine is priming—steam also rushes out in jets with the condensed water, according to the movements of the piston in the cylinder, until the cocks are shut. But this practice is, of course, universal, and is not confined to the two particular types you mention.

[Reply to GEOFFREY SHARPE.]

Tractive Power.

This formula has been given many times already, and is included in most textbooks. It is usually stated thus:—

$$T = \frac{D^2SP}{W}$$

D = diameter of cylinder in inches; S = stroke of piston in inches; P = mean effective steam pressure per square inch of piston area; and W = diameter of driving wheel in inches. This applies to an ordinary two-cylinder engine. The formula takes no account of speed nor of boiler capacity, and is, therefore, purely of comparative and relatively theoretical value. [Reply to A. C.]

The "Southern Belle."

We have ourselves seen this train hauled by a Stroudley 0-4-2 engine—by No. 177 mentioned by you, in fact—but only with the lighter loads taken on week-days a number of years ago. The point of the reply to Mr. Beck was, however, that this had occurred recently and with the present-day loads which it would be altogether unreasonable to expect one of these engines to take and to keep time. There are still various other important trains, some of considerable weight, taken by these engines, as you point out.

[Reply to J. N. MASKELYNE and A. H. HASTIE.]

West of England Services, S.R.

On sections such as that mentioned between Exeter (St. Davids) and Okehampton, it is often necessary to take into account the movements of trains other than those immediately in question, or to consider the conditions at one or both ends of the section. Considerations such as these, together with other factors which may not be apparent but which are realised by the officers concerned, frequently account for differences in the timings of apparently corresponding trains over a particular section.

[Reply to R. S. JOHN.]

Boiler Pressures, Great Western Railway.

All the 4-6-0 express passenger engines and the 2-8-0 mineral engines (except the "Castle" 4-6-0 class and the "4700" 5 ft. 8 in. 2-8-0 class) carry a uniform boiler, pressed to 225 lb. per sq. in., and the pressure of the larger boilers carried by the two last-mentioned types is also 225 lb. We believe the original intention was to fit a "4700" boiler to the "Castle" class 4-6-0's, but that a rather smaller boiler was fitted ultimately in order as far as possible to keep down the weight of the latter engines.

[Reply to F. J. THOMAS.]

Great Western Railway Locomotives.

4-4-0 engine No. 3297, *Earl Cawdor*, was one of the earliest developments of the "Badminton" class which preceded the "Cities" and formed an experiment in regard to the very large boiler and special form of cab fitted. This would be about 20 years ago. This engine may still retain these special features, as we have neither seen nor heard of it for a number of years past, but it is more probable that it has since been rebuilt to accord with other engines of the "Badminton" class, with which it is now numbered as 4105.

[Reply to R. M. SOWERBY.]

Permanent Way Caution.

F. L. C. G. points out that our previous reply only partially meets the case. The

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"black distant" signal referred to is painted green, with the fishtail away from the line concerned and a pointed end towards it; at night a green light towards the former and a white light near the latter. Its main purpose is to give a pre-warning of the approach to a section where reduced speed is necessary, of which the letters "C" and "T" indicate respectively the commencement and termination.

[Further reply to C.M.]

Vacuum Brake Connections.

Apparently, the duplicate couplings which you have noticed on certain Colonial and foreign locomotives, notably those of the South African Railways, are required in view of the fact that a central position is not always convenient because of the centre couplings largely used on 3 ft. 6 in. gauge railways. Duplicate connections are therefore provided to enable coupling to be made with vehicles or engines either way round, while permitting shunters to keep clear of the coupling bosses.

[Reply to S. RICHARDS.]

Locomotive Efficiency.

In the best circumstances of present-day design, the overall thermal efficiency of the steam locomotive does not exceed 7 per cent. We know of one application only of the Diesel system of internal-combustion engine applied to locomotive propulsion, and results do not justify any supposition that this type of prime mover will supersede the locomotive as we know it. There may, however, appear to be some future for the turbo-condensing type of engine.

[Reply to J. J. H.]

Restaurant Cars on Scottish Railways.

An East Coast dining car is, we understand, used for the services between Aberdeen and Inverness and a Pullman restaurant car between Inverness and Helmsdale. Your remarks as to smart working at Euston are noted, according to which at one platform, within 25 min., a Coventry express had been removed, followed by a Manchester express, and after it had gone away empty, a Birmingham express.

[Reply to J. A. RANNIE.]

Locomotive Renumbering L.M.S.R.

Possibly you have obtained a copy of the February number having a blurred figure, but if you will refer again to page 140, you will find that the numbers allotted to the Caledonian 0-8-0 goods engines are given correctly as 17990/7 and not as 17900/7. We cannot say whether, if alterations such as those you mention are made, engines will be renumbered to accord with their new classification, but regard this as hardly likely. We are advised that No. 9367 has been reclassified as Class 4 instead of Class 5.

[Reply to N. F. STEVENS.]

London and North Eastern Railway Pullman Cars.

For the last two or three years both first and third class Pullman cars have been in use on various sections of the late Great Eastern Railway, in addition to restaurant cars. During the summer months there is, in fact, a complete Pullman train between Liverpool Street and Clacton-on-Sea. Please see the RAILWAY YEAR BOOK and past issues of the RAILWAY MAGAZINE for further information.

[Reply to F. B. CONWAY.]

London Midland and Scottish (Caledonian Section) Locomotives.

Renumbering was dealt with first in the January RAILWAY MAGAZINE and more fully in the February number. No doubt, in Scotland, as in England, rolling stock of various sections of the grouped railways is to be seen where hitherto it was never used. No importance, therefore, attaches to such observations. There are a number of old 4-4-0 outside cylinder engines on various parts of the Caledonian section.

[Reply to "MOGUL."]

London and North Eastern (G.E.) 0-6-0 Tank Engines.

Although the numbers of the old 0–6–0 tank engines 37–40 will be required for the new series numbered 31–40, it does not follow that the displaced locomotives will be scrapped. They may be given new numbers or placed on the duplicate list and worked in that condition for some time yet.

[Reply to "CAERPHILLY."]

Brighton Section Electric Traction.

Work is well advanced in the equipment of further sections of the Brighton

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suburban system for electric traction, but no information is yet available as to the date when electric trains will commence to run to Coulsdon. We are obliged for your note to the effect that the present electric stock is appearing with large numerals to indicate the class. Several electric motor vans have been constructed for use when further sections are electrified.

[Reply to T. D. CARNWATH.]

Locomotive Power Classification in Ireland.

We are advised officially that goods engines of the Great Northern Railway of Ireland now bear letters indicating power classification, based upon the axle loads of the engines and their power capabilities. A and E are the lowest power classes, B, C and D each being proportionately higher.

[Reply to T. D. CARNWATH.]

Great Western Railway Locomotive No. 2900.

You are correct in pointing out that the first 4-6-0 express passenger locomotive on the Great Western Railway, No. 100, *William Dean*, is now numbered 2900 and not 2908, as shown by a typographical error in the February number. This information was correctly given in a recent issue. [Reply to A. H. HASTIE.]

The Locomotive "Booster."

The advertisement from an American railway publication sent by you is issued by the Franklin Railway Supply Company, Inc., the firm which is dealing with the "boosters" fitted to American locomotives, and it is their design which has been adapted by Mr. Gresley for his booster-fitted engine No. 1419.

[Reply to T. K. GASTEEN.]

Railway Coats-of-Arms.

All the coats-of-arms of the leading railways prior to grouping were reproduced in colours in the serial "Our Home Railways," by W. J. Gordon, published some years ago. The Midland coat-of-arms was given in No. 2 of the series, the Great Eastern in No. 6, and the Great Northern in No. 8.

[Reply to MICHAEL DWYER.]

Southern Railway Locomotives.

A considerable number of the larger 4-4-0 engines of the B4 class used on the Brighton section have been rebuilt as in the case of No. 55, and many others, if not all, will, no doubt, be dealt with similarly in due course.

[Reply to T. D. CARNWATH.]

Great Western Railway 2-8-0 Locomotives.

So far as we are aware, "4700" class 2-8-0 mixed-traffic locomotives are permitted over practically all the principal main routes of the Great Western Railway, including the Severn Tunnel. Seven or eight of these engines, if not more, are, we understand, now in service.

[Reply to J. C. P. W.]

Abandonment of part of Newmarket Branch, London and North Eastern Railway.

The proposed abandonment merely affects part of the *original* Newmarket branch, which left the main line in the centre of Cambridge station, and has now for some time been used as sidings.

[Reply to K. H. F. G.]

High Peak Line, L.M.S.R.

On the steepest sections trains are assisted by cable haulage, the gradients being much too severe for adhesion traction with anything of a load. Apparently, the section you noted is one upon which the cable is provided.

[Reply to R. HALKETT JUN.]

Crewe.

This station has not been described in our "Notable Railway Stations" series, but has formed the subject of several comprehensive articles under other titles, those in the September, 1899, and June, 1904, numbers being the most important.

[Reply to W. H. FRITH.]

Metropolitan Railway.

For full particulars in regard to this line, see RAILWAY MAGAZINE for September, 1922, or, pending the publication in April of the 1924 edition of the RAILWAY YEAR BOOK, that for 1923.

[Reply to D. M. G. CLARKE.]

Great Northern "Pacifics," London and North Eastern Railway.

Twelve Great Northern "Pacifics" are at work, numbered from 1470 to 1481 inclusive, and 40 more are building.

[Reply to J. S. COLMAN.]

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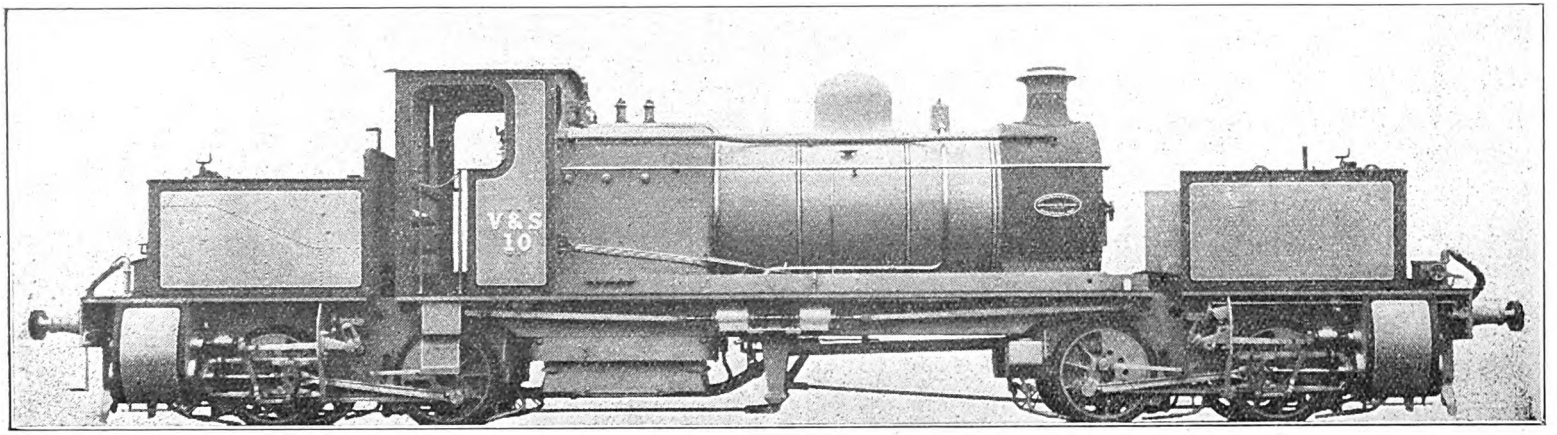
THE FIRST "GARRATT" LOCOMOTIVE IN GREAT BRITAIN.

BUILT BY BEYER, PEACOCK & CO., LTD., FOR VIVIAN & SONS, LTD., SWANSEA.



THE locomotive illustrated has been constructed for working in and around the Hafod Copper Mine, over lines having a ruling gradient of 1 in 20, and a maximum curvature of 97 ft. radius.

The engine will take curves of 90 ft. radius, standard gauge, and is of considerable power for its dimensions. Cylinders are 13½ in. × 20 in.; wheel, 4 ft. diam.; group wheelbase, 5 ft. 6 in.; total wheelbase, 32 ft. 2 in.; boiler diam., 5 ft.; heating surface, 1,406 sq. ft.; grate area, 22·7 sq. ft.; weight in working order, 61 tons 9 cwt. 2 qrs.

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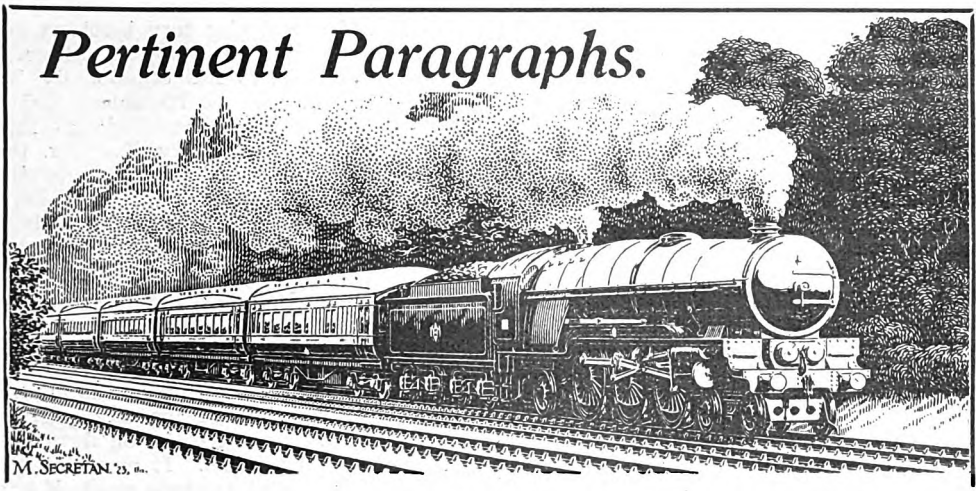
Pertinent Paragraphs.



The Railway Strike.

COMMENCING at midnight on Sunday, January 20, and concluding on Tuesday, January 29, the strike of locomotive enginemen, organised by the Associated Society of Locomotive Engineers and Firemen, produced results which caused great inconvenience and expense to the general public, reduced railway earnings by a substantial amount, entailed manufacturing difficulties and placed many workers, such as miners, temporarily out of employment owing to the breakdown of transport. It produced results which, although acclaimed as a "victory" by the Society, actually vindicated the reasonableness of and supported the award of the National Wages Board which was in dispute. Indeed, what modification was made was of so minor a character that it could no doubt have been obtained by constitutional means, for which reason the attempt of the Associated Society to regard the settlement as a "victory" was farcical in the extreme, while Mr. Bromley's grievance that his Society had a "bad press" is merely evidence that to all reasonable minds he had a "bad case." There is no need to deal further with the matter, except to suggest that the whole matter was well summarised by a remark published by the *Railway Gazette* and then used by the *Evening Standard* under the heading "The Issue in a Nutshell," which described the issue as being—"Whether awards by responsible bodies set up for the specific purpose of deciding such matters, after calling for complete evidence and hearing all sides, and whose formation was approved by all parties concerned, the signatories including even representatives of the dissenting party or parties, are to be binding or not."

Earnings of Locomotive Enginemen.

IN view of the many misconceptions as to the facts of locomotive enginemen's earnings, a statement recently published by the *Railway Gazette* gave some useful figures. It was then explained that all enginemen receive, first, a basic wage which, except for the modifications which became effective from January 20 (these are now to be applied in stages), and which constituted the *raison d'être* for the recent strike, is governed by terms which have been operative since August 18, 1919, by virtue of an agreement then made between the various railway companies, the National Union of Railwaymen and the Associated Society of Locomotive Engineers and Firemen. Under this agreement a driver receives from 12s. to 15s. per day of eight hours, and a fireman from 9s. 6d. to 11s., with standard additions according to the number of years' service in the particular grade. Except for such differences as arise in view of the fact that, naturally, men in the superior grades are given the more responsible duties, every engineman, whether on express, ordinary, local or branch passenger or goods trains, or on shunting duty, receives the same basic rate of pay. Each man also receives standard increases to cover overtime, night and Sunday duty, &c. These conditions apply to by far the greater proportion of locomotive enginemen, a proportion which has been estimated as being as high as 96½ per cent.

There are, however, a number of turns, notably those including the working of long-distance express passenger trains, which introduce the "mileage" element. To cover this condition, what is known as the mileage system is adopted. Prior to January 20

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this became applicable as soon as a mileage of 120 had been made, beyond which the men were paid at the rate of an additional hour for each 15 miles. Thus, a driver or fireman whose train was booked to travel 200 miles in the eight hours would receive eight hours' pay for the first 120 miles and 5½ hours' pay for the remaining 80 miles, a total of 13½ hours' pay. He would, of course, receive the same allowances and extra payments in regard to overtime, night and Sunday duty, &c., as in the case of a man who did not come under the mileage arrangements. In such a case, which was quite a usual one, the estimation of pay became a complex matter, as shown by the following example :—

Book on duty	2. 0 a.m.
Arrive at shed signal	2.15 a.m.
Station "A," depart	2.30 a.m.
Station "B," arrive	6. 0 a.m.
Station "B," depart	7.45 a.m.
Station "A," arrive	11.40 a.m.
Relieved on arrival, off duty ..	12.0 noon.
Hours from signing on to signing off duty	10 hours.
Light engine from shed to station "A"	2 miles
Train miles from "A" to "B" ..	115 miles.
Light engine from "B" to shed and back	2 miles.
Train miles from "B" to "A" ..	115 miles.
Light engine from "A" to shed ..	2 miles.
	236 miles.

Payment would be made up as follows :—

120 miles .. .. .. equals	8 hours.
116 miles .. .. .. ,, (Seven hours at 15 miles each and one hour for the odd 11 miles.)	8 hours.
Night allowance from 2 a.m. to 4 a.m. (One-quarter time extra on time worked.)	30 mins.
Day overtime allowance from 10 a.m. to 12 noon .. .. .. (One-quarter time extra on time worked in excess of eight hours per shift.)	30 mins.
Gross payment	17 hours.

Overtime within Eight Hours.

NOT infrequently mileage enginemen were able to complete their 120 miles, or their daily run whatever it might be, in 7 or 7½ hours. In these cases payment was made on the mileage basis in exactly the same way as if the men had been on duty the full ordinary shift of eight hours. In fact, in many instances, the useful mileage was run in considerably less time, as the following example covering a turn of 168 miles will show. This particular turn involves completion of train-running time in under five hours, and the trip has occasionally been completed and the men booked off duty in seven hours. On the basis of 120 miles, equalling eight hours' duty, however, these men received 11 hours' pay, the additional 48 miles being reckoned as the equivalent to three hours beyond the standard eight hours, the odd three miles (as being under five) not being counted. On some lines even greater mileages are regularly made by express enginemen, and there are instances where, even without night or other allowances apart from the standard overtime rates, drivers and firemen were able to make as many as 17 hours as estimated for pay purposes, although not required to be on duty much in excess of 10½ hours. It was also quite common for men who did not much, if at all, exceed eight hours' time to be paid for five or six hours additional.

While it is reasonable to argue that men on duties of this kind should be adequately paid, it cannot be said that the strain involved is so great as to justify the very large increases in remuneration resulting merely from the fact that a train is worked for a considerable distance on a fast schedule and little or no time occupied by intermediate stoppages. Indeed, it may be suggested that frequently enginemen on turns involving numerous stops, and whose work is complicated by shunting here and there, may in many instances have a more arduous task than their *confrères* engaged on fast through expresses. It is, in fact, mainly because of this very rapid increase in remuneration above the standard, without commensurate additional strain, that the railway companies asked that the eight-hour standard should be made 150 instead of 120 miles, a change which was considered to be justifiable by the National Wages Board after very full and careful inquiry. It must be borne in mind that neither "mileage" nor ordinary duty enginemen suffer any reduction or alteration in respect of basic, overtime, night or Sunday duty rates, while the small proportion representing the odd 3½ per cent. (after allowing for 96½ per cent. on standard rates as above mentioned) comprises entirely men who obtained advantage from the "mileage" system and received the highest rates of pay.

L.M.S. Posters by R.A.'s

REFERENCE has already been made to the posters which are being painted by eminent Royal Academicians for the London Midland and Scottish Railway. On Friday, January 18, some of the originals were exhibited at Mr. Norman Wilkinson's studio, nine original

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Photo.] [*Barrett's Photo. Agency.*

MR. NORMAN WILKINSON, THE ORIGINATOR OF THE SCHEME.

canvases painted by as many Royal Academicians being available.

The eminent painters whose work was on view had been given an absolutely free hand as regards choice of subject and style of painting, as the pictures themselves very clearly showed, and the result was at once impressive and pleasing. Among those shown were Mr. D. Y. Cameron's "Scottish Highlands," showing purple mountains standing boldly out against a beautiful sky; Mr. George Henry's "Edinburgh Castle," a fine study of the noble pile in the northern city—in blue and grey and green; Mr. Arnesby Brown's picture of "Nottingham Castle"; Mr. Richard Jack's fine representation of "steel works"—understood to be at Motherwell—with tall, black, smoke-belching chimneys standing boldly out against a sky of orange and blue; Mr. Adrian Stokes' "Shakespeare's Country," a picture of Warwick Castle in a setting of vivid blue and green, with a charming water reflection; "Conway Castle," by Sir D. Murray; Mr. Algernon Talmage's "Brig o' Balgowrie," Aberdeen, a particularly bright study in blue and grey and green; a low-relief plaque in monotone entitled "Speed," and showing a flying figure, presumably intended to represent Icarus, the first flying-man, rushing through the air, the painter being Sir Bertram Mackennal; "Carlisle—the Gateway to Scotland," including an heroic figure in armour mounted on a white horse with scarlet trappings, the red and white flag of St. George being well in evidence; this is by Mr. Maurice Greiffenhagen.

Railway Stations and the Architects.

PRESUMABLY it is good business from their point of view, but we could wish that when dealing with artistic and architectural aspects of our railway stations, bridges, office buildings, &c., the architects would recognise not only their utilitarian character, but also the fact that most of them were built many years ago—that railway companies cannot usually incur the expense of artistic architecture for its own sake. Moreover, nearly all of the *relatively few* stations, bridges and other buildings in other countries concerning which they enthuse so volubly were erected either under privileged conditions or to fulfil purposes much beyond those of railway premises as such. We are constrained to write in this strain by reason of an article in a recent issue of the *Westminster Gazette*, wherein Prof. Reilly passes some very uncomplimentary remarks in regard to British railway station architecture, while at the same time discussing the R.A. posters which have been or are to be displayed on railway premises. His point is summarised by the remark that "the big railway termini in America have no posters, but are in themselves fine architectural schemes; the big termini in this country, especially the recent ones, like Victoria, have no architectural scheme, but plenty of posters."

We quite agree that "if railway transport is the great and wonderful thing a great many people . . . think it to be, the thing in itself is worthy of fine expression." Also that "the terminal station is the gateway of the town." What is forgotten or ignored is that most of our terminal stations began as small affairs; they were enlarged bit by bit, and development was often governed by surroundings, so that but few have given the architects of their day any chance of distinguishing themselves on the lines which their successors deem desirable. They were usually built, too, when severely utilitarian ideas were prevalent, while cost has always been a paramount consideration.

Comparisons which are not Comparisons.

WHEN, however, the matter is analysed further it will be seen that usually no reasonable comparisons are justified. Prof. Reilly quotes a New Yorker who remarked on visiting one of our termini, "Say, man, it's a vaudeville." The professor then continues to compare Waterloo and Victoria with the Grand Central and Pennsylvania stations in New York, of course to the disadvantage of the former, oblivious of the fact that the latter are modern structures, built for display and accommodating premises which are only indirectly railway, such as shops, restaurants, &c., to an extent far beyond the relatively small provision on the same lines at our own stations. He does not allow for the fact that if we could build entirely new premises *to combine the traffic of several of our present stations*, and

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there was a similar demand for non-railway accommodation, we should probably be able to equal anything which America can produce. Moreover, he does not say anything about the relatively ordinary character of the "train sheds" where the real work of the station is done. Admittedly they are good in the case of modern American stations, there are few in other countries which would attract much of the admiration given to the palatial premises which mask them. As for the great Continental stations, whatever may be the case with their exterior appearance, there is not much behind to invite adverse comparisons with our own modern stations.

Grouping as it affects Locomotives and Rolling Stock.

Now that the effects of grouping are beginning to show themselves relatively distinctly in regard to the use of engines or vehicles hitherto belonging to one section but now run more or less frequently on others, there is only limited occasion for chronicling various instances thereof in these pages. In view, however, of the large number of communications received mentioning instances where locomotives and rolling-stock have appeared under previously unusual circumstances, attention will continue to be given to the more interesting examples thereof which come under our notice or of which particulars are received. At the same time, space cannot be given for such reference on an extended scale, and while we shall continue to appreciate communications from readers in reference thereto, only such items as do not appear to be the natural result of grouping can be given special reference.

There are, however, several matters in this class of which brief mention may now be made. Mr. W. R. Brown, of Balsall Heath, Birmingham, mentions the appearance of a Midland superheater 4–4–0 locomotive, No. 557, on a Euston-Wolverhampton turn, whereas hitherto the compounds have been principally employed. Midland engines have also been used on Euston–Manchester trains. He also refers to the working of the 1.55 p.m. train from New Street to Liverpool and Manchester, which is regularly worked by a London and North Western and a North Staffordshire locomotive.

Miscellaneous Notes.

A MEXBOROUGH reader, after a few remarks in regard to "B" locomotives of the Great Central section, including the Lancashire, Derbyshire and East Coast 0–4–4 tanks and some Great Central 0–6–0 goods engines, mentions that locomotives of all the English sections of the London and North Eastern Railway are now working in the Mexborough and South Yorkshire districts. He also refers to the use of a North British set of corridor vehicles working between Hull and Liverpool. Reference is also made to a London Midland and Scottish (Midland) 2–4–0 engine bearing the new crest on the side of the cab instead of the letters L.M.S.

In regard to the Southern Railway, Mr. E. R. Farr mentions that a number of the electric-unit sets are now painted and lettered according to the new style. These, in common with all newly painted carriages on the South Western section, now have the weights given in tons only. The electric sets do not now bear a distinguishing letter and are numbered as sets commencing at 1244. Carriage trucks and milk vans are being painted green, although open wagons retain the old brown. Among engines painted and lettered according to the new practice are 0–4–4 tank No. 53, painted passenger green, and No. 496, an "Adams" 0–6–0 tender locomotive, which is painted black instead of dark olive green as formerly. Various engines of the "300" and similar classes are being rebuilt, as also 0–6–0 goods engines. Mr. Farr refers to the frequent appearance of the "736" class on the Portsmouth route and to the extending use of rebuilt 4–4–0's on the Salisbury trains. A West of England reader refers to repainted South Eastern and Chatham section 0–6–0 locomotives, now in black livery.

With regard to the Great Western Railway, the reader last mentioned refers to various main-line locomotives which are now at work painted and finished in pre-war style, and to certain variations in practice for respective classes in regard to the position of the crest or its absence, of the words "Great Western," and of number and name plates. He also points out that the old 4–4–0 engines, Nos. 7 and 8, are now numbered 4171 and 4172 respectively, their old numbers being borne by 2–6–2 tank engines. No. 3417, formerly *Francis Mildmay*, now bears the name *Lord Mildmay of Flete*. A second locomotive of the "Castle" class, *Caldicott Castle*, is now at work.

Train Sickness.

IT is difficult to set any limitation upon the range of possible scares which can be set up in the pages of a newspaper, but it would be hard to find a parallel to a letter published some time ago in the pages of the *Daily News*, under the heading "Why I Hate Trains." The writer, a Major W. T. Blake, complained that when travelling "by what is, I believe, the fastest train in Britain"—one of the Bristol-Paddington non-stops, so that there is not much to quibble about in regard to

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this description, even if it is not strictly accurate—he had to leave his lunch before finishing the first course " and hasten away to be violently sick time after time." He then described the journey as far worse than a Channel crossing, and compared it unfavourably with air travel, of which, apparently, he had had considerable experience.

It is just possible that Major Blake was unfortunate in travelling just when a particular coach was not quite in the best of trim. We have, indeed, had one or two experiences of such conditions in the course of some forty years of railway travel. But this has never occurred in regard to a principal express, and it is almost beyond comprehension that so important a train as that in question could be allowed to run in a condition liable to cause train sickness, and especially that the dining-car should be the vehicle in question. There are some people who suffer from train-sickness on the slightest provocation, but they are very few and far between. It is practically certain, too, that they would also be sufferers from air-sickness if travelling by air. Obviously, therefore, Major Blake was suffering from liver, or other trouble, and that was responsible for the fact that he could not, on that occasion, stand even the ordinary running shocks of a journey which is notable for its freedom from junctions and curves likely to cause rough riding. We may also ask why, if this is not the first time he has " suffered in similar fashion in trains," and this particular journey was " certainly the most uncomfortable trip " he had ever endured, he had booked for lunch at all—for which, presumably, he paid, if he did not obtain substantial benefit therefrom !

An Auto-Train Collision.

On November 29 last an auto-train consisting of small 2-4-2 tank engine, No. 1305, and two bogie coaches, the latter leading, ran through Palace Gates station, Great Eastern Section, London and North Eastern Railway, and collided with two engines in the loco coal yard beyond. The leading vehicle was damaged beyond repair, and the driver, fireman, guard and several passengers were injured, the train staff somewhat seriously. The control gear for backward working is air-operated, and the immediate cause of the accident was the fact that the engine regulator had become jammed in the full open position after the train had left the preceding station, though it was suggested that the regulator control had not been coupled up after the fireman (who alone occupied the footplate) had removed the pin, in order to set back as became necessary to start from Noel Park station. Whether this was so or not, Major Hall concludes that when the regulator was closed by the fireman after the train had set back, the cross arm, instead of falling into the jaw of the control rod, passed behind it. When the control was operated by the driver, the rod actuated the regulator by its frictional grip on the front of the arm, and in doing so travelled along it and was in consequence so displaced that it became jammed in that position. Principal blame is placed upon the fireman in that in setting back at Noel Park he was required only to reverse the engine and not to take the regulator under his own control. Unfortunately, the disconnection of the regulator gear resulted in the regulator becoming jammed in the open position, so that the fireman was unable to close it himself. Had he manipulated the reversing gear instead of trying to close the regulator, his attempts to meet the emergency might have been more successful. As the Inspector points out, repetition of all the circumstances which led to the collision is improbable, and there is little to criticise in the control mechanism used. He makes some suggestion, however, as to the mechanical details.

Standard Time on U.S.A. Railways.

It is pointed out by our American contemporary, the *Railway Age*, that it is now forty years since " standard " time was adopted by United States railways. Previously many standards of time were in use, with the result that long through journeys entailed consideration of many time variations, apart from confusion and misunderstandings on the part of the travelling public. There were, in fact, prior to 1883, no fewer than 49 different standards, and where several railways served one city three or four standards might be in use at the same place. It is said, indeed, that in some towns, business men who did much travelling had watches with two minute hands, to show times, say, 12 minutes apart. Credit for the introduction of four standard times throughout the United States, changing an hour at a time, with clearly defined changing points selected on a systematic basis, is claimed for the late Mr. W. F. Allen, then Secretary of the General Time Convention. This body later developed into the American Railway Association. It is difficult to understand why there should have been any great objection to a measure which seems to be of so common sense a character, but it was by no means an easy task to override prejudices, satisfy various objections and reconcile conflicting factors. However, as from November 23, 1883, " standard time " became the rule on United States railways. Mr. Allen was editor of the United States Official Guide from 1872 to 1915. He gave credit

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first to Prof. C. F. Dowd, who advocated the system in 1869, for general use as well as for the railways. Various proposals in support followed, but it was as Secretary of the General Time Convention that Mr. Allen had the honour of being regarded as "The Father of American Time Standards."

Railways in South Australia.

IN directing attention to tenders which have been invited for the construction, to the order of the South Australian Government Railways, of a number of new locomotives and rolling-stock (in several instances it is specified that they are to be constructed in Australia), an Adelaide reader, Mr. R. N. Smith, adds some remarks in regard to railway matters in South Australia. The announcement referred to covers five 2-8-2 engines, 20 4-8-2 and 10 4-6-2 locomotives for the 5-ft. 3-in. gauge; 9 steel petrol-driven rail motor cars for the 5-ft. 3-in. gauge, and 1 steel petrol-driven motor car for the 3-ft. 6-in. gauge; 700 40-ton steel gondola cars; 100 30-ton steel louvred cars, and 500 30-ton steel box cars for the 5-ft. 3-in. gauge, together with two wrecking cranes and a number of locomotive boilers. Mr. Smith points out that this call for tenders for locomotives and rolling-stock is part of a large scheme for bringing the South Australian railways up to date. He continues: "Mr. W. A. Webb, the new Chief Railways Commissioner, who arrived to take up his duties in November, 1922, was formerly Manager of the Missouri, Kansas and Texas Railroad of U.S.A., where he had direct control of all branches of the railway. Prior to his institution as Chief Commissioner the Railways Commissioner could only order new locomotives, &c., by permission and sanction of the Chief Mechanical Engineer and other officials, and so it was in every department. Mr. Webb, however, has been given full control and all departmental officers are in direct communication with him; his great difficulty will, I think, be the Government, to whom he is responsible for all expenditure, &c., as they seem rather disinclined to allow the four millions necessary for development."

Locomotive Traffic Developments.

"ALTHOUGH he has been here only nine months he has caused the brasswork of the locomotives to be painted over to save the cost of cleaning; through tickets from town to town through Adelaide have been instituted, where before two were required; advertising on the railways has been adopted for the first time, and now stations are beginning to blaze with gaily coloured hoardings and placards; weekly excursion tickets are now issued from the country to Adelaide; several train services have been accelerated, and more are promised with new locomotives; main lines are being laid with 80-lb. rails instead of 60-lb., and rails on country lines are being increased in weight. Where, formerly, loads of 12 tons per four-wheeled truck were allowed on 40-lb. rails, these rails are now allowed to carry 14 or 15 tons in a 16-ton truck. Dining cars have been ordered for long-distance traffic, and also corridor trains. Previously the only corridor train was the Adelaide-Melbourne express, which also runs a dining car, and this stock was jointly owned by Victoria.

"Now larger locomotives, of 60,000 lb. tractive force, to supplant the 'biggest' locomotives in use, 4-6-0's, of 20,000 lb. tractive force, are used for goods traffic almost exclusively on the 5-ft. 3-in. gauge and for all passenger trains on the mountainous south line. The 'Mountain' type will be the passenger, and the 'Santa Fe' type the freight locomotives for the mountains, and the 'Pacific' and 'Mikado' types will be used on the other broad-gauge lines. The new freight vehicles will take the place of 16-ton steel trucks, 10-ton box-wagons and 30-ton open bogie trucks, the biggest in use at present. Another innovation is the portioning of the system into five divisions, each with divisional superintendent and engine shops and yards. These superintendents communicate their actions to the Chief Commissioner daily. The rail motor cars are for the use of division officials."

Alternative Great Western Route West of Exeter.

SOME time ago a fall of rock blocked the Great Western main line between Dawlish and Teignmouth, with the result that the traffic to the west was diverted over the Southern Railway (London and South Western section) between Exeter and Plymouth, until the debris was removed. It has been overlooked by some that the Great Western Railway has for twenty years past possessed an alternative route between Exeter and Newton Abbot, that is almost as direct as the main line along the coast and up the Teign estuary. The inland line in question, which is single, branches from the main line just west of St. Thomas station, Exeter, and follows more or less the main coach highway to Newton Abbot. At Heathfield, 16 miles from St. Thomas, it joins the Moretonhampstead branch, where the local service connects with the trains to and from Newton Abbot, the total distance to that station being 20 miles. By the main line the distance from St. Thomas to Newton Abbot is 19¼ miles. The line from St. Thomas to Ashton is, or

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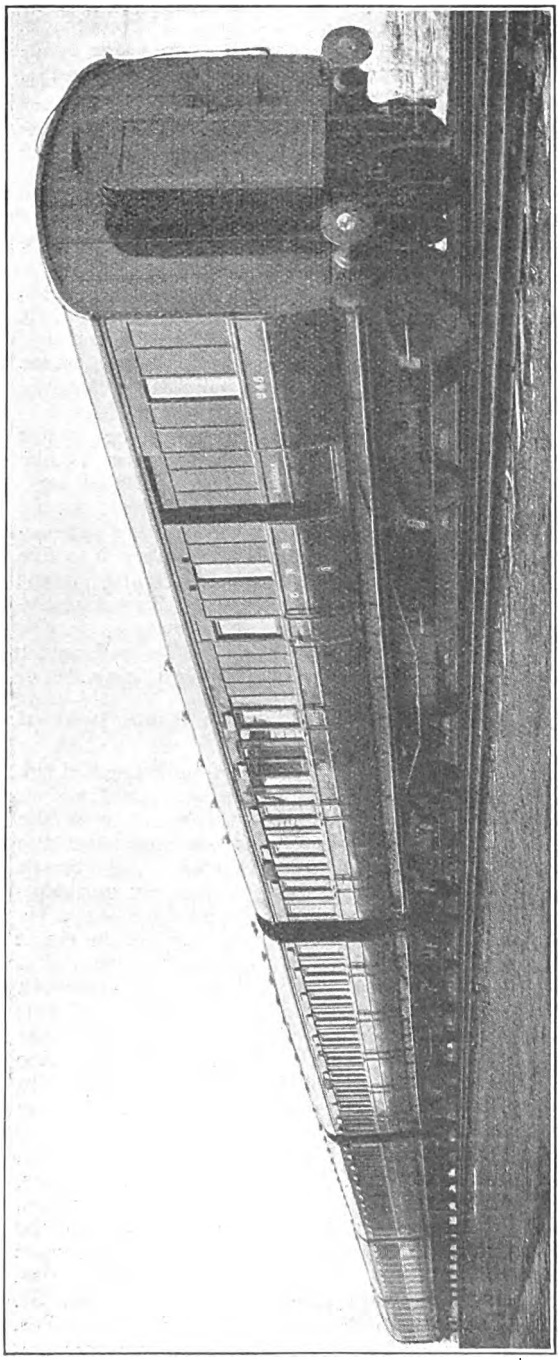
was, owned by an independent company, known as the Exeter Railway* (originally called the Exeter, Teign Valley and Chagford Railway), and was opened July 1, 1903. At Ashton an end-on junction is formed with the Teign Valley branch of the Great Western Railway. The Great Western Railway works the Exeter Railway, the trains working through between Heathfield and Exeter.

* The Exeter Railway has been absorbed in the Great Western group.



TRAIN OF NEW PASSENGER CARRIAGES USED FOR PRINCIPAL SERVICES, GREAT NORTHERN RAILWAY (IRELAND).

In view of the Great Western Railway having this alternative route which just avoided the obstructed length of line, it appears to be unusual that the train service was diverted to the competitive Southern Railway route, which did not permit of the Great Western Railway trains rejoining the Great Western Railway main line till Plymouth, 28 miles west of Newton Abbot. There are steep gradients on the Exeter Railway (but not so steep as on the Hembledon incline), but we are unaware of any physical difficulties that would interfere with the *Riviera Limited* travelling by this route.

Traffic Operation on French Railways.

A READER who adopts the pen name of "Dieppe," while asking several questions in regard to French railways, also supplies a number of comments upon observations while travelling in France during last summer. As a number of the points raised are of general interest they may be briefly referred to, combining comment and reply.

"Dieppe" first refers to a 4–6–0 locomotive observed hauling a local train on the Etat line between Rouen (Orleans) and Serquigny, a junction on the Cherbourg main line. As he points out, the engine was very similar to the "Castle" class on the Highland section of the London Midland and Scottish Railway, though painted in Etat livery (black with brass bands on the boiler). This was one of several engines built just before the war by the North British Locomotive Company to meet a locomotive shortage on the French railways. The Highland "Castle" design was adopted as a convenient one, with minor modifications only. If we recollect rightly, there were 50 of these engines.

"Dieppe" further points out that although the Etat line possesses some fine corridor coaches used on principal trains, "the average four-wheeled coaches are very

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uncomfortable, although they are very smooth riders." He also refers to the 4–6–2 locomotives used on this line, including some built by the North British Locomotive Company a few years ago, but, in that case, to French designs. The use of metal wedges on the chaired sections of the Parish-Havre line is suggested to be a cause of "roaring" rails, so noticeable when travelling between Havre and Rouen.

French Railway Station and Train Working.

SOME other comments may be quoted without remark: "The station at Rouen (Rive Droite) is being rebuilt and enlarged. The new features are a spacious passenger concourse and booking hall combined, and a clock tower. The tunnels at each end are being enlarged. The whole scheme is being carried out in ferro-concrete. In point of speed the Etat is nothing like so good as its smaller neighbour, the Nord. The latter line's Calais-Paris rapide, non-stop except for a water replenishing service stop at Abbeville, is a fine run. The country between Calais and Boulogne is very hilly, and speed through Amiens is restricted to a crawl, owing to the line passing through the station, which is on a curve, and a serious "bottle-neck" at one end of the station. The principal Nord rapides are hauled by "Pacifics," and I have not yet seen any of the mammoth "Baltics," famous in pre-war days, though there may have been only one of that class."

"Branch-line working is very primitive. On one branch, on the Etat, from Barentin, on the Havre main line, to Caudebec-en-Caut, there were only three trains each way a day, one being mixed. The only locomotives used were 0–6–0 tender type, with outside cylinders, and of a very antiquated design. For some reason or other these locomotives were only allowed to run chimney forwards, thus necessitating a turntable at each end At the tiny branch station at Caudebec-en-Caut, the reversal loop at the terminus is only reached by a turntable. The last is only just big enough to hold the wheelbase of the engine, the tender being turned separately. Thus the turning of the engine is a lengthy business of about ten minutes. The tender has to be uncoupled and the engine run on to the table, turned, and run off on to the loop. The tender has then to be pushed by the station staff in their shirt-sleeves on to the table, turned and pushed behind the engine and coupled. The coaches used on the branch were of the most primitive four-wheeled type, whilst the tracks were usually covered with grass and weeds. The greater part of French permanent way is grass-grown, and plate-layers are hardly ever to be seen."

Booster Locomotives.

WRITING from the United States, Mr. G. A. Ross, in referring to a remark in the October, 1923, RAILWAY MAGAZINE, to the effect that in America the booster has principally been applied to freight engines, sends particulars of some Southern Pacific 4–6–2 passenger locomotives to which this appliance has also been fitted, as well as to some "Atlantic" locomotives belonging to the same railway, and some new 4–8–2 engines classified as for passenger service. With regard to the "Atlantics," which have superheaters, feed-water heaters, and other modern appliances, as well as boosters, he quotes runs made by two of these engines between San Francisco and San Louis Obispo. For the run of 248 miles, with an average load of 433 tons and an average time of 7 hrs. 20 min., based, respectively, on 14 and 11 trips, averages, respectively, of 12·21 and 11·23 gallons of fuel oil per 1,000 ton-miles were consumed. The first passenger engine to have a booster was, however, a "Pacific" No. 2475, which was so fitted in 1922. The new 4–8–2 passenger locomotives mentioned are used between Los Angelos and El Paso (Texas), and are designed for making the run of 815 miles without change of engine, though necessarily several crews take charge.

Benefiting a Competing Railway.

COMPLEMENTARY to the article on "Round-about Railway Routes," published in the November number, the case of railway communication with Weymouth is of interest. The London and South Western Railway had reached Dorchester in 1847, but it was not till January, 1857—nearly 10 years later—that Weymouth, only 7 miles distant, was provided with railway accommodation. There was no incentive to the Great Western Railway, its owners, to an earlier opening of the line to Weymouth, as its completion produced veritable dead sea fruit to the Great Western Railway—which had absorbed the Wilts, Somerset and Weymouth Railway, a broad gauge line incorporated in 1845 for a railway from the Great Western Railway through Dorchester to Weymouth. The London and South Western Railway sought for powers to continue its line from Dorchester to Weymouth, but the best Parliament would do for it was to compel the Wilts, Somerset and Weymouth Railway to mix the gauge from Dorchester Junction to Weymouth so as to accommodate the narrow gauge trains of the London and South Western Railway.

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In exchange the London and South Western Railway had to mix its gauge between Dorchester and Wareham, a distance of 15 miles, to enable broad gauge trains to run over this section of the London and South Western Railway.

As the distance from London to Weymouth by the London and South Western Railway would be only 145 miles against 168¾ miles by the Great Western Railway, the latter railway was not particularly anxious to complete the line, it being obvious that the London-Weymouth traffic would be conveyed by the much shorter narrow gauge route, and not by the broad gauge, with a line 23¼ miles longer. Under these circumstances, the Great Western Railway developed the Wilts, Somerset and Weymouth section in connection with the Bristol and West of England district of its system. It is interesting to record that up to about thirty years ago the only Sunday service between Weymouth and London by the Great Western Railway route was via Bristol. By the opening of the direct Bournemouth line in 1888 the length of the London and South Western Railway route to Weymouth was reduced to 143 miles, thus increasing its advantage over the Great Western Railway for the London-Weymouth traffic. However, the opening of the direct line between Patney and Westbury in 1906, with the adoption of the Berks and Hants section for main line expresses, reduced the length of the Great Western Railway route between London and Weymouth to 154½ miles, and an excellent service of express trains is run in the summer. In some quarters it is expected that competition between the Southern Railway and the Great Western Railway for the valuable Weymouth traffic during the coming summer will result in accelerated services.

Somerset and Dorset Joint Railway Locomotive.

MR. AHRONS writes as follows: "In my article in the February issue, page 101, I inadvertently referred to S. and D.R. locomotive No. 11 as a 0-6-0 side-tank engine. This should have been 2-4-0 side-tank engine. It was built by G. England and Co., of Hatcham Ironworks, London, in 1862, and shown at the London Exhibition of that year. The official dimensions were: cylinders (outside), 11 in. by 17 in.; coupled wheels, 4 ft. diam.; total heating surface, 700 sq. ft.; pressure, 120 lb.; tank capacity, 520 gallons; weight, 17 tons in working order. An illustration of this engine appeared in the RAILWAY MAGAZINE, February, 1905, page 118."

Station Name Indicators.

THAT it is by no means easy to devise a type of station name-board which will meet the needs of travellers by day and, at the same time, suit the conditions of night travel, is shown by the very varying practices of the respective railways and the number of trials of special systems which have been made at one time or another. The problem is further complicated by the fact that the conditions at country stations, at large junctions or busy intermediate stations, and on suburban lines, have to be correlated to some extent, while the lighting medium available—electricity, gas, or oil—may be a controlling factor so far as night indications are concerned. A number of tests have recently been made on the London Midland and Scottish Railway, mainly at Kilburn station, on the London and North Western section. These include for day conditions, two name-boards placed at an angle; also various types of name-boards set well back, and more numerous than is usual except at busy stations. Among the latter is a design consisting of a large white panel with two thick black circles to constitute a "bull's-eye" target, across which is placed a straight panel bearing the name of the station in white letters on a black ground. With the name section extended to allow of a large size of letter to be adopted, this arrangement has much to commend it. For night use it has been decided that wherever square lamp casings already exist they shall, as they call for attention, be placed diagonally, and names shown on the two angular faces towards the line, so as to facilitate reading from either direction and from the side. In other cases suspended name-boards will be placed a short distance behind, and at a slightly lower level than existing lamps of bowl type (electric or incandescent gas), so that the name is illuminated without the dazzling effect occasioned by close proximity to the light itself. Experiments have also been made with transparent name-boards, and with various arrangements of surface illumination.

Standardisation of Government Railways in China.

As pointed out by the Chinese Economic Bulletin issued by the Chinese Bureau of Economic Information, the last few years have seen considerable standardisation and co-ordination in the work and services of the Chinese Government Railways. At the time of the first year of the Republic, 1912, each of the twelve or thirteen railways under Government control had its own train schedules, without reference to the schedules of the others. Each sold its own tickets, which were printed in different languages.

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A passenger had to buy a different ticket and re-check his baggage when he transferred from one line to another, and usually had a long wait at the junction into the bargain. Baggage which might be carried in the car on one line had to be checked on another, and parcels checked on one line had to be carried by the passenger himself on another. Similarly, goods had to be transferred from one line to another under the care of the shipper himself, because the railways did not look after transfers. Distances and weights on different lines were calculated in different units of measurement. The rolling stock and other equipment were constructed in different designs. Operating expenses and earnings were difficult to compare because there was no uniform system of accounting.

Now the metric system of weights and measures is in use on all lines. There are through trains running between principal cities, and where lines meet at junctions, train schedules are so fixed that a passenger can usually step from one train on to the other without waste of time. The passenger buys his ticket at the station where he begins his journey, and he can go to almost any station on any other line without having to buy another. Chinese is always printed on the tickets, although English and French are usually found in addition. A ticket may take a passenger to Japan, now that through traffic arrangements with that country have been made. Baggage goes all the way without having to be re-checked, and parcels can be forwarded in the same way. Freight is transhipped in the same car over different lines, and through bills of lading are now used.

The Government railways are now standardising rolling stock. Standard designs for freight cars of different types have been agreed upon. Even in handling tenders for purchase of railway supplies the Ministry of Communications has laid down uniform rules. A conspicuous improvement is the adoption of a uniform system of railway accounting whereby an annual report combining operating and financial statistics of all Government lines is placed in one volume. It shows the growth in the length of line, capital investment, revenues, expenses, financial charges, traffic carried, train and locomotive kilometrage, and number of railway employees. Different lines are also compared on the basis of unit averages. Since 1915, the Government's interest in the railways has increased by $114,000,000, of which $35,000,000 represents permanent Government investment, $53,000,000, additions to property through surplus, and $26,000,000 funded debt, retired through surplus. The total earnings in 1922 were $99,790,000, and the length of the lines about 7,000 kilometres, not including 480 kilometres of the Shantung Railway.

Decline of the Rail Motor.

AT the end of 1922 the total of steam rail motors owned by British railways was only 115. Thirteen years earlier the total was 185. This decrease, which year by year becomes more marked in the number of rail motors, shows that such combinations are not altogether successful. Yet theoretically a self-contained unit for railway working is ideal for branches and sections where traffic is light, and also for providing frequent services.

The chief drawback to the success of the rail motor is that when the engine requires repair or attention the whole car is put out of service. This defect has in a measure been met by making the locomotive detachable from the passenger car. But the separation of the two parts is not a simple matter that can be performed in a short time. The weight of the combination and the need for absolute rigidity of the whole require the connections between the units to be of a strong and substantial character.

Duplicate engine portions must be available if the passenger unit is to be kept in traffic, and the parts of both units that are connected must be standardised to enable exchanges to be made. The 115 steam rail motors existing at the end of 1922 were owned as follows:—G.W. 65, L. & N.W. 25, North Staffordshire 3, and Knott End and Nidd Valley 1 each. Of these, the G.W. only had 36 available for use and but 23 in actual service, the figures for the late L. & N.W.R. being 15 and 11 respectively. The five railways only had 37 in actual use.

Statistics of 1909 and 1922.

IN 1909, railways utilising steam rail motors for passenger traffic and the number so employed were:—Alexandra (Newport) Docks & Railway 2, Barry 2, Furness 1, Great Central 6, Great Northern 6, Great Western 80, Isle of Wight Central 2, Kent & East Sussex 1, Lancs. & Yorks. 15, L. & N.W. 6, L. & S.W. 25, L.B. & S.C. 5, Midland 2, N.S. 2, Rhymney 2, S.E. & C. 8, Taff Vale 16, Caledonian 1 and G. & S.W. 3. It will be observed that the South Wales railways made much use of rail motors. These lines owned 22 in 1909, all of which had disappeared at the end of 1922.

The general practice appears to have been to scrap the combination when the engines required renewal, although a few of the locomotives have been retained as 4-wheel shunting engines. If the G.W. and L.M. & S. Railways adopt the policy that has caused the rail motor to disappear from other

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railways, it is only a matter of a few years before it will once again become a thing of the past. Railway officers of 70 years ago, like those responsible for the revival of the steam rail motor car, looked upon the combination as a cheap and efficient transport machine. Doubtless its abandonment in the 'fifties arose from the same cause that leads to its withdrawal to-day.

Electric Railway Development.

At the end of 1922 the extent to which English railways had been converted from steam to electricity was not considerable in relation to the total mileage. The *tubes*, constructed as electric railways, represent 37¾ miles of the 111½ miles of railway worked solely by electric traction. The biggest conversion is that of the Metropolitan District, 24¾ miles. Solely electric lines outside the London suburban area are responsible for over 30 miles, leaving about 19 miles in the London area, not already enumerated. This includes sections of the Metropolitan and various joint lines.

Steam railways over which electric trains are worked show a larger mileage, 262½ miles in all, but the total length of electric and electrified lines is only 374 miles. The North (L. & Y.) division of the late L. & N.W.R. is responsible for 50½ miles of the 262½ miles, and the old L. & N.W. Railway for 24¾ miles. The late L. & S.W.R. comes first in the extent of its electrification, accounting for 56 miles, the earlier pioneer south of the Thames (the late L.B. & S.C.R.) having only 25 miles electrified. The Metropolitan Railway has 26 miles, and the late North Eastern Railway 48½ miles.

Electric Traffic Mileage.

The total mileage of electric passenger trains, including empty running during the year 1922, was 32,081,716, of which 27,014,692 miles were run in London and suburbs. The average number of vehicles per train was :—hauled by electric engines 5·31, by electric motor vehicles 4·75, and by electric trams 1. The mileage by electric trams was performed by the Great Central Railway (210,460), Liverpool Overhead Railway (269,385), and Midland Railway (Burton & Ashby Light Railway) 239,271, and 48,384 miles by the Burton Corporation trams on the Burton & Ashby Light Railway. Such mileage scarcely merits inclusion in electric railway returns. Its obvious place is in electric tramway statistics. The circumstance that the running was performed by railway companies is responsible for its appearance in the Railway Returns for 1922.

The electric mileage of freight trains on British railways is inconsiderable. The Metropolitan ran 4,976 train miles, and the late North Eastern 80,057. Electric locomotives were employed by both railways.

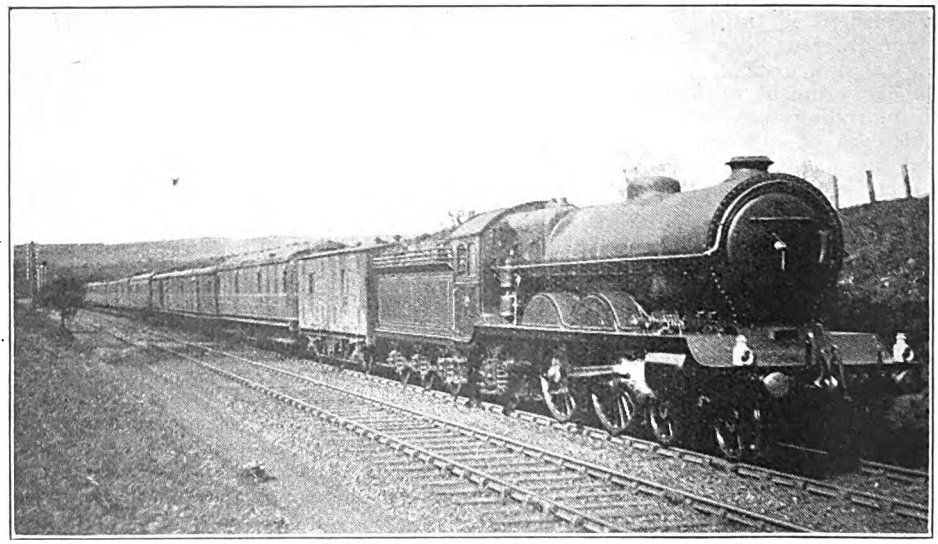

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*Henry L. Salmon.*

King's Cross and St. Pancras—Aberdeen Express near Stonehaven, North British 4-4-2 locomotive No. 872 "Auld Reekie."

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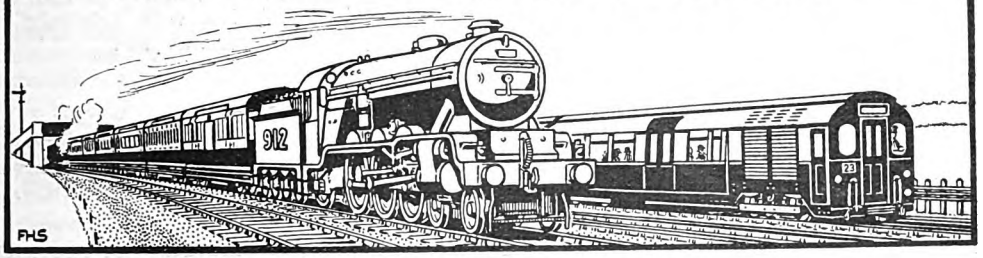
WHAT THE RAILWAYS ARE DOING.



MR. JAMES MILNE, C.S.I., who has been appointed Assistant General Manager, Great Western Railway, entered the service in 1904 as a pupil in the locomotive department at Swindon. Afterwards transferred to Paddington, he had experience in the office of the Superintendent of the Line. This was followed by a period in the General Manager's office, where successively he was engaged in the Statistical and Board of Trade sections. He returned to the office of the Superintendent of the Line in 1912, working in the passenger train running section. In 1916 he became Chief Clerk to the Divisional Superintendent at Pontypool Road. After a short experience as Acting Assistant Divisional Superintendent, Swansea, he went in the following year to Plymouth as Assistant Divisional Superintendent. In September, 1919, Mr. Milne's services were requisitioned by the Minister of Transport, under whom he held the office of Director of Statistics in the Finance and Statistics Section of the Ministry. Returning to Great Western Railway, Mr. Milne was, on January 1, 1922, appointed Assistant to the General Manager, and in April of the same year he succeeded Mr. F. W. Showers as Principal Assistant. Later in the year Mr. Milne was selected to accompany the Indian Retrenchment Committee, of which Lord Inchcape was chairman. The valuable services rendered by this Committee are well known, and following upon his return to Paddington in April, 1923, to resume his duties as Principal Assistant to the General Manager of the Great Western Railway, the C.S.I. was awarded to Mr. Milne in the King's Birthday Honours for that year. He is a graduate (B.Sc.) of Manchester University, and an Associate Member of the Institution of Civil Engineers.

MR. J. MILNE, C.S.I.,

Assistant General Manager, Great Western Railway.

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MR. W. A. STANIER, who has become Principal Assistant to Chief Mechanical Engineer, Swindon, Great Western Railway, joined the service at Swindon in 1892, becoming a draughtsman in 1897, and in 1900 Inspector of Purchased Material. In 1901 he was Technical Inspector in the running shed at Swindon, and at the beginning of 1903 Assistant Locomotive Superintendent for the Swindon division. The following year he was in a similar capacity in the London division, and two years later returned to Swindon as assistant in the management of the Locomotive Works. A few months afterwards he received the appointment of Locomotive and Carriage Superintendent of the Swindon division. At the beginning of 1913 he succeeded to the position of Assistant Manager of the Locomotive Works, becoming Manager in 1920. In 1922 Mr. Stanier was appointed Works Assistant to the Chief Mechanical Engineer, thus leading to his present position as Principal Assistant.

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MR. J. AULD, who has been appointed Docks and Personal Assistant to Chief Mechanical Engineer, Swindon, Great Western Railway, was formerly Chief Mechanical Engineer to the Barry Railway. Mr. Auld served an apprenticeship on the Glasgow and South Western Railway, and subsequently held appointments on the Great North of Scotland Railway and the London, Tilbury and Southend Railway prior to its absorption by the Midland. Returning to the Glasgow and South Western Railway, he was appointed District Locomotive Superintendent at Glasgow, but in 1910 was appointed Locomotive Superintendent of the Barry Railway. On the amalgamation of the Barry Railway with the Great Western Railway, Mr. Auld was at first appointed Mechanical Engineer at Barry Docks and Divisional Locomotive Superintendent for the Cardiff Valleys division, but in September, 1922, became Docks Assistant to the Chief Mechanical Engineer of the Great Western Railway.

* * *

OFFICIAL advice has been issued of the following changes in the legal arrangements of the London Midland and Scottish Railway:—Mr. H. L. Thornhill is appointed Chief Solicitor as from January 1, 1924. Messrs. Beale & Co. will act under Mr. Thornhill's general control in connection with Parliamentary matters, and will also act as Divisional Solicitors from their office at Birmingham in respect of an area which will shortly be defined.

* * *

MR. H. L. THORNHILL, who has been appointed Chief Solicitor to the London Midland and Scottish Railway, was educated at Sutton Valence, and was articled in 1894 to the late Mr. Chas. H. Mason, then Solicitor to the London and North Western Railway. In April, 1899, he was appointed Assistant in the Common Law Department, and as an Assistant under Mr. C. de J. Andrewes, who was appointed Solicitor in 1903, he acquired great experience of Railway and Canal Commission practice. In 1915 Mr. Thornhill was appointed Assistant Solicitor to Mr. M. C. Tait, who succeeded Mr. Andrewes, and he entered his new duties on returning in 1919 from active service in France. Mr. Thornhill went (in 1920) with Mr. Geoffrey Marshall, Goods Manager of the Great Northern Railway, to the United States to study and report on the principles of railway rates, and gave evidence before the Rates Advisory Committee on behalf of the Railway Companies' Association with reference to proposed changes in railway law.

* * *

THE RIGHT HON. SIR WILLIAM J. GOULDING, Bart., has been unanimously re-elected Chairman of the Irish Railway Clearing House Committee for year 1924.

* * *

THE Minister of Transport has appointed Mr. F. Gordon Tucker, O.B.E., T.D., to be his Private Secretary, and Mr. R. C. Morrison, M.P., to be his Parliamentary Private Secretary (unpaid).

MR. H. L. THORNHILL,

Chief Solicitor,
London Midland and Scottish Railway.

MR. W. J. BLACK, of the Canadian National Railways, London, has, from January 1, 1924, become European Manager, Department of Colonisation and Development. His headquarters are 17–19, Cockspur Street, London, W.C.

* * *

ON Saturday, Tuesday and Wednesday, January 26, 29 and 30, the Dramatic Section of the T.O.T. Philharmonic Society gave splendid performances at the King's Hall, Covent Garden, of the Gilbert and Sullivan comic opera "Iolanthe." It will be recalled that when the Society gave "The Gondoliers" in October last, votes of the audience were invited as to the work next to be undertaken. Hence, the selection of "Iolanthe." The Dramatic Section of the Society, together with the orchestra, numbers about 100,

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recruited entirely from the "Underground" and allied companies' staffs, including all the principals; the director, Mr. Emil Hardy; the choral conductor, Mr. Ewart Beech (who also conducted the orchestra for the public performances); and Mr. C. F. Lambert, orchestral conductor. The principal characters were taken by the following: Lord Chancellor, Mr. Cyril Corker; Earl of Mountararat, Mr. John Priestley; Earl Tolloller, Mr. Thomas Dean; Private Willis, Mr. George Nicoll; Strephon, Mr. Alec Pleasance; Queen of the Fairies, Miss Beatrice Smith; Iolanthe, Miss Mary Stone; Leila, Miss Nan Lloyd; Celia, Miss Edith Griffiths; Fleta, Miss Norah Webber; and Phyllis, Miss Madge Cook; together with a Chorus of Fairies and a Chorus of Peers. All three performances attained a very high standard of excellence, and the audience cordially endorsed remarks made by Mr. H. E. Blain, Assistant Managing Director, at the conclusion of the final performance, to the effect that, although entirely amateur, the standard reached was one which might be envied by professional performers, other than those of the highest rank. Mr. Blain also referred to the special services rendered by the producer, the conductors, and by the committee of the Society, of which Mr. J. P. Thomas is chairman. A large number of directors and chief officers attended on each occasion, Lord Ashfield, president of the Society, being present on the Tuesday. Forthcoming arrangements include a Bohemian Concert at Queen's Hall on March 31, while the Dramatic Section propose to give "The Yeomen of the Guard" on October 23, 24 and 25.

* * *

A CHANGE literally assuming the character of a transformation is in progress on the Lancashire coast between Blackpool and Lytham St. Anne's. Half a century ago St. Anne's—now amalgamated in the ancient parish of Lytham—was a mere village, containing a few cottages, a church, and a roadside inn. To-day the two districts form a well populated and rapidly expanding high-class residential area, the successful growth of which is due in the main, if not exclusively, to the enterprise of the Lancashire and Yorkshire and London and North Western Railways in providing a service of fast trains, which have tempted Manchester merchants and many others to build houses for the occupation of themselves and their families, where they can have the benefit of invigorating air from the sea. The original station accommodation in the territory has, in the circumstances, proved insufficient for modern requirements, and additional facilities are everywhere being provided, the latest enlargement being at St. Anne's, where an entirely new station of greatly increased capacity will shortly be completed.

* * *

AN experiment has been carried out on the London tube railways with a view to reducing the congestion at important interchange stations. It consisted of doubling the illumination on the platforms at these stations. At points like Piccadilly Circus, Oxford Circus, Tottenham Court Road, Leicester Square, Charing Cross, where the heaviest Underground traffics are experienced, it is a highly important matter that the traffic should be kept as fluid as possible. Recent tests which have been taken go to prove that the introduction of these higher powered lamps has resulted in a speeding up of the traffic.

* * *

IN connection with the reconstruction of the City and South London Railway, the tubular shafts for the reception of the escalators at Stockwell have been completed, and the work of installing the escalator machinery is proceeding. The escalators will be of the reversible type, so that both escalators may operate in the same direction if and when required. Stockwell residents will find it hard to recognise their 34-year-old Tube station when it is reopened for traffic. They will find the lifts have disappeared, and in their place escalators giving direct connection with the platforms. The journey from the booking hall to the platform will occupy only 55 seconds. One of the principal improvements will be the much-increased size of the booking hall. The new hall will have an area of 3,000 sq. ft. as against 600 sq. ft. in the old station, and passimeters will displace the "hole-in-the-wall" method of booking. In addition to these improvements, the plans provide for the rebuilding of the station building itself. The new station will be of distinctive design, and its attractiveness will be enhanced by a scheme of terra-cotta tiling. The two entrances will also be much wider.

* * *

MILLIONS of blasts of guards' whistles have been heard at Charing Cross station on the District Railway since it was opened 53 years ago, but the Underground has decided that no more trains in future shall get their "right-away" from the shrill screech. On the night of February 6, at 12 p.m., whistles became obsolete so far as Charing Cross is concerned, and all trains are now started by the more tuneful jingle of bells. The new device enables the train service to be considerably accelerated. For

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a long time past the Underground Railway has been making experiments with a view to eliminating altogether the use of the guard's whistle on the District Railway, partly because of complaints from passengers. A simple but efficient method has now been perfected which in time is to be installed at every station between South Kensington and Whitechapel. It consists of a suspended wire, which in the case of Charing Cross extends for 180 ft. at the near end of the platform, and all the guard has to do is to depress the wire—with his green flag raised in the air—which causes an electric signal bell to ring at the front end of the platform. During the busy hours two bells, one in the front and the other in the centre of the platform, will be used. Experience has shown that the use of whistles on the District Railway caused delay in starting trains, especially in the case of the very long ones when, with a train running on the opposite track, the rear guard had sometimes to blow his whistle several times before the front guard heard it. Tests with the bell device give an average saving of four seconds in the starting of long trains. The bells will also act as a warning to passengers, who will be able to hear them the whole length of the platform.

* * *

Mr. J. Sowden writes: "May I add to 'Furnessian's' remarks in the January Railway Magazine that the Furness and Midland 0-6-0 goods engines working through Barrow and Leeds trains arrive at Stourton (Leeds) at 9.54 p.m. and depart next day full at 4.10 p.m. Furness engines work this train up to Leeds on Mondays, Wednesdays and Fridays with a Furness brake van. The numbers of those which have worked it lately are 28 (Furness livery), 12,500 and 12,505, painted black with L.M.S. on cab side."

* * *

On certain sections of the London and North Eastern Railway, if not generally, a number of engines are appearing with new numbers. Mr. C. G. Woodnutt reports the appearance of a number of late Great Central locomotives with their numbers increased by 5,000, including four-cylinder 4-6-0, ordinary 4-6-0, 4-4-2, 4-4-0 and other passenger locomotives, together with some of the 4-6-2 tank engines. Great Northern 0-6-2 tank engine No. 1,751 is now No. 4,751.

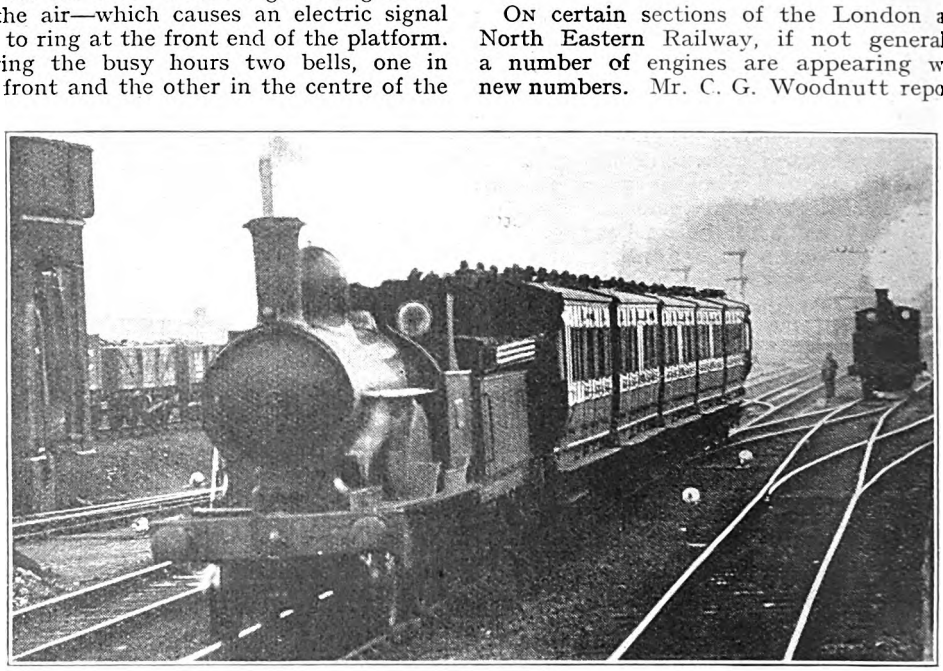

Photo.] [*D. S. Foulkes-Roberts.*

LONDON MIDLAND AND SCOTTISH RAILWAY.

Up local train leaving Denbigh. L. & N.W. 2-4-0 engine, No. 1666, "Ariadne."

* * *

Our Crewe correspondent, Mr. C. Williams, reports: All the new 0-8-4 shunting tanks are now in traffic, the last, No. 7,959, having left the shops early in February. Of the most recent ones, Nos. 7,951 and 7,953 are at Edge Hill; Nos. 7,955 and 7,958 at Longsight; No. 7,956 at Stockport; No.

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7,952 at Shrewsbury; and No. 7,954 at Stafford. The remainder, or most of them, are at work in the Abergavenny district. No. 1,929, "Polyphemus," is the latest Jubilee class compound to be converted to two-cylinder simple (Renown class). A new ordinary boiler is now fitted to this engine in place of the old one with Belpaire firebox. Further compound mineral engines are being simplified and superheated. These include No. 1,283 ("B" class), which will shortly be running. No. 737, "Roberts" (6-ft. straight link class), has been transferred to the Engineering Dept., and is now "Engineer Lancaster." The old latter, a 6-ft. curved link engine, has been broken up. Only two of the curved link class now remain, viz., "Engineer Bangor" and the spare engine. Engines recently re-numbered include Special Tank No. 3,283 (L.M.S. 7,393), which is the first shunting engine to be dealt with. The new number occupies practically the whole of the lower cab panels, while the initials "L.M.S." occupy a position on each side of the saddle-tank. This engine, which is stationed at Holyhead, is one of the few now running fitted with a standard smoke-box.

* * *

To give an air of similitude to a model railway station miniature posters are a necessity, and to meet this requirement Messrs. Bassett-Lowke Ltd. have produced a remarkable series of miniatures. They are reproductions, in the exact colours, of the best known posters issued by the leading

A BASSETT-LOWKE MODEL RAILWAY POSTER HOARDING.

railway groups in Great Britain. In addition to posting them on model stations, the miniature railway owner can fix them on hoardings, or on his embankments, &c. The price of the posters is 9d. for a packet containing three dozen, assorted, and for those unable to make their own hoardings these are supplied at 3s. 6d. each, as illustrated on this page. The firm have a second series in hand of the leading steamship well-known posters.

* * *

WILLIAM BEARDMORE & CO. LTD. have recently carried out two shipments of locomotives for India direct from their locomotive works into the hold of the steamer berthed in the firm's own fitting-out basin at Dalmuir, 300 yards from the locomotive shops.

* * *

THE well-known firm of Vernon Smith & Sons Ltd., who deal largely in models, railway and otherwise, have transferred to more commodious premises at 87 and 89, High Road, Chiswick, where a fine model railway track is being fitted up. When complete it will be operated by Mr. Vernon Moldon, an expert in model working and operation.

* * *

ON January 30, the first day of normal services after the railway strike, a remarkable non-stop run was made on the Great Western Railway by the 1.30 p.m. express from Paddington to Worcester, a distance of 120½ miles. Owing to the fog the train was 35 minutes late in leaving Paddington, starting at 2.5 p.m., but it arrived at Worcester at 4.3 p.m., having covered the distance in 1 hour 58 minutes, a saving of 12 minutes on the booked time, the average speed being 61·2 m.p.h. The engine was No. 2988 and the weight of the train was approximately 260 tons. Following is the train log:—

Stations.	Distances. Point-to-Point. M.	C.	Times.	Point-to-Point Speed.
Paddington	—	—	p.m. 2.5	—
Reading	35	78	2.41	59·9
Didcot	16	70	2.57	63·2
Oxford	10	52	3.7	63·9
Yarnton	3	65	3.10	76·2
Kingham	17	34	3.28	58·0
Moreton-in-Marsh	7	2	3.34	70·2
Campden	5	14	3.39	62·1
Evesham	9	60	3.48	65·0
Worcester (Shrub Hill) ..	13	65	4.3	55·2

* * *

STANDARD colours for the rolling stock of all lines now included in the Southern Railway are to be as follows:—

Passenger and mixed traffic engines—Green (olive) picked out with black and white lines.

Goods engines—Black picked out with green lines.

Coaching stock—Green (sage) picked out with black and yellow lines.

* * *

IT is reported from Paris that the work of surveying the route for the proposed broad gauge railway between Beirut and Tripoli, in Syria, has been begun, and a definite line has been traced out over 30 km. of a total distance of 96 km. The two parties which are surveying the route and estimating the probable cost of construction left Beirut and Tripoli simultaneously, and are expected

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to meet in about three months' time. The complete plan will then be drawn up in Paris, and it is hoped that the construction of the railway may be begun in five or six months' time. This line will link up Beirut with the Tripoli-Homs-Aleppo line, and thus with the Baghdad Railway, which itself unites Constantinope and Mosul. It will also provide land communication between Paris and Beirut, by way of the Orient express, the Baghdad Railway, the Northern Syrian-Cilician system, and the Syrian system. Another 100 km. of line from Beirut southwards would link up with the Palestine-Egypt system, and communication would thus be established between Paris and Cairo by way of Syria.

* * *

MR. J. F. GAIRNS had an appreciative audience when on a recent evening he lectured before the Engineering Society of the City and Guilds Engineering College, South Kensington, his subject being "Locomotive Construction, Maintenance and Operation." A fine selection of lantern slides was used for illustration. In introduction, the lecturer outlined the principal factors which distinguish the locomotive from any other type of steam engine. He then referred briefly to fuel and efficiency aspects, comparing steam with electric and internal-combustion traction engineering. In view of the fact that the audience consisted largely of engineering students, Mr. Gairns did not deal in great detail with general construction, but passed in review, with appropriate comments, several construction slides. These were followed by a series of slides, exhibited by courtesy of the Locomotive Publishing Company Ltd. for the first time, showing various stages in the erection of a L. & N.E. (G.N.) three-cylinder 4-6-2 locomotive of Mr. H. N. Gresley's design. A number of views of various British locomotives were then shown, including a few of earlier days, but the majority of more modern classes. Examples of small engines for special purposes were followed by pictures of American locomotives and trains, and then by some of European engines. The lecture concluded with illustrations of the Port Carlisle "Dandy Car," the Ljungström turbine locomotive (Sweden), and an example of internal-combustion practice.

* * *

MR. E. C. COX, C.B.E., Chief Operating Superintendent, Southern Railway, speaking at a southern divisional operating staff dinner at Brighton, expressed appreciation of the manner in which the difficult conditions which reorganisation had caused had been met and congratulated the staff upon having Mr. Latham as their chief. He referred also to the way in which difficulties occasioned by the recent strike had been met with within the division, and emphasised the need for all, particularly the younger men, to make themselves acquainted with work other than that with which they were directly concerned. There was need to recognise that, although formed into divisions and districts, the railway had to be operated with what was, in fact, one staff and one personnel, all in the service of one railway. In responding, Mr. Latham thanked Mr. Cox for his words of appreciation and encouragement. Using the letters of the word "Southern," which applied both to the division and to the railway, he suggested that they might be interpreted to indicate S—Service; O—Observation; U—Unity; T—Thought; H—Harmony; E—Efficiency; R—Retrenchment (to make the best out of the minimum of resources); N—*Nil Desperandum*.

* * *

THERE was a remarkable gathering of influential representatives of the transport and allied industries at the fifth dinner of the Institute of Transport held at the Savoy Hotel on February 14. Sir Joseph G. Broodbank presided, supported by Mr. Harry Gosling, M.P. (Minister of Transport), Sir Samuel Hoare, M.P., Sir William Joynson-Hicks, M.P., and many other distinguished personages. Mr. Harry Gosling, M.P., proposed "The Institute of Transport and the Transport Industry," and he had a most cordial reception from the assembly numbering 250 persons. He regarded the great problem of transport, he said, as one of the most vital things in the country. He expressed the hope that he would have the opportunity of helping to solve the very great and difficult problem of London traffic. Sir Joseph Broodbank, in reply, dealt with Mr. Gosling's connection with water transport, and then confined his remarks to the Institute of Transport and its work. The institute, said Sir Joseph, was founded, like the Ministry of Transport, at the psychological moment when the public mind became seized with the infinite imperative necessity of co-ordinating the instruments of transport. The institute offered an area for the discussion of all developments of the transport industry, especially in their relation to one another. Subsequent speeches of a singularly appropriate character were made by Sir William Joynson-Hicks, M.P., Sir Samuel Hoare, M.P., and Sir R. Francis Dunnell.

* * *

AT the annual general meeting of the members of the Railway Club, at headquarters, 65, Belgrave Road, London, S.W.1, on

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February 15, a very satisfactory report was presented by the hon. secretary, Mr. K. Ffitch, and the balance-sheet furnished by the hon. treasurer, Mr. L. H. Bailey, well bespoke the progress the club is making. Mr. Cecil J. Allen was re-elected President for another year, and Mr. W. J. Bassett-Lowke was made a vice-president. All the officers of the club were re-elected for another year's service, and so likewise were the members of the committee. A vote of thanks to them for past services, proposed by Mr. W. Parker, was responded to by Mr. H. W. Bardsley. After the business was concluded a very able address was given by Mr. Cecil J. Allen, and an animated debate followed.

* * *

AMUSEMENT has been caused in numerous quarters by a letter addressed to *The Observer* by three members of the Merton College Caledonian Club, Oxford, respecting one of the Yorkshire posters displayed by the L.M.S. Railway. These Oxonians of Scottish extraction wrote: "A certain railway poster of a somewhat flamboyant nature depicts a Highland lassie on an equally Highland moor, and underneath is inscribed this truly cryptic slogan, "On Ilka Moor bacht 'at." The Merton College Caledonian Club has devoted no little time to a fruitless attempt to translate the last two words, and now feels itself compelled to refer the question to the ingenuity of a wider public." The inquirers received an editorial explanation as follows:—Our correspondents have been misled by the word "ilka," which is good Scots for "every," but in this case stands for the Yorkshire town of Ilkley. The London, Midland and Scottish Railway Company say that the poster in question depicts a Yorkshire lassie on Ilkley Moor, and that the line, "On Ilka Moor bacht 'at," taken from an old song, may be rendered "On Ilkley Moor without a hat." The poster was originally issued by an Ilkley town association and displayed by the Midland Railway.

COAT OF ARMS OF THE LONDON MIDLAND AND SCOTTISH RAILWAY COMPANY.

* * *

THE thirteenth Cross-country Championship meeting of the London Railways Athletic Association was held on February 16 at the Southern Railway (Western Section) Sports Club Ground, Raynes Park. The course was in two laps making 5 miles in all, starting from and returning to the ground. Eight teams entered, two from the London Midland Athletic Club, one each from the Brighton and South Western sections of the Southern Railway, one each from the Metropolitan and District Railways Athletic Associations, together with the Great Western Railway and Great Eastern Railway Harriers. A total of 89 men started, of whom 78 completed the course. The challenge trophy previously held by the Great Western Railway Harriers was won by the London Midland "A" Team. Medals awarded to the first three men finishing were won by C. E. Blewett, Great Western Railway Harriers, J. Wilson, Metropolitan Railway A.A., and A. Machin, London Midland "A" Team. Mr. R. E. L. Maunsell, C.B.E., Chief Mechanical Engineer, Southern Railway, acted as starter, afterwards awarding the shield and medals. Mr. Maunsell was supported by Mr. F. Bushrod, O.B.E., Chief Assistant to Chief Operating Superintendent; Mr. F. J. Pape, Indoor Assistant to General Manager; Mr. A. H. Hoyle, London (West) Divisional Operating Superintendent; Colonel C. J. Francis, C.B.E., Stores Superintendent; Mr. W. Buckmaster, O.B.E., late Chief Clerk to the General Manager; Mr. H. Richards, Assistant Electrical Engineer, and other Southern Railway officers.

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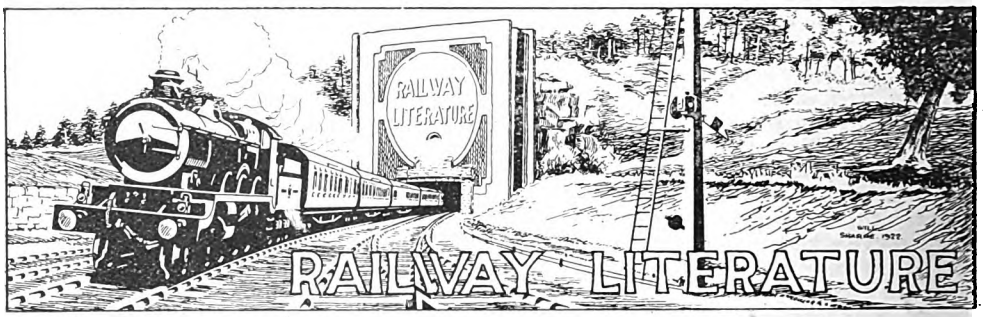

THE TRAVEL KEY CONTINENTAL TIME BOOK AND EXPRESS ROUTE GUIDE. [Published by E. Gascoine, 30, Higher Drive, Purley, Surrey. Price 2s. monthly.]

This publication constitutes an attempt to produce a Continental time book and guide combining A.B.C. and train service information, and to present it in a clear and easily understood manner. Judging from the first issue, that for January, 1924, these objects have been very well attained. A very clear type, not too small, and printing on substantial paper, together with a large number of sectional maps showing essential information without complication, facilitate reference and understanding very materially. Each important touring country forms a separate section of the book, except that certain closely-connected groups, such as Scandinavia, are associated together. These groups, which cover the whole of Europe, together with Syria, Palestine and Turkey-in-Asia, are arranged alphabetically, with the names at the head of each page in bold type. Each section has one or more maps very clearly drawn, while the various train service tables are well classified and clear of much information which would be of use only for local purposes and inclusion of which would tend to complicate matters from the point of view of the through traveller. A complete index is provided in front, together with a collection of miscellaneous information of value to travellers. Routes between Great Britain and the Continent are shown in the British section. The 24-hour system is employed throughout. Changes of time are clearly indicated. A list of consuls and other officials in England, together with a summary of the passport regulations and various special aspects of Continental travel, is given on a very full through concise basis. In addition to railway services, sections are included showing the principal air routes and services and the principal steamship services between European and Mediterranean seaports.

CATALOGUE OF THE COLLECTIONS IN THE SCIENCE MUSEUM, SOUTH KENSINGTON: LAND TRANSPORT—III, RAILWAYS, LOCOMOTIVES AND ROLLING STOCK. Compiled by E. A. Forward, A.R.C.Sc., M.I.Mech.E. [London: H.M. Stationery Office, Imperial House, Kingsway, W.C.2. Paper, 9¾ in. × 6 in. 106 pp. Price 1s. net.]

For students of railway and locomotive history Mr. Forward's careful compilation will be of great value for reference purposes, quite independently of its *raison d'être* as a guide to the railway, locomotive and rolling-stock exhibits at South Kensington.

The comprehensiveness of the catalogue is amply demonstrated by the list of "Contents." Under the heading of "Locomotives," these include: Early Experiments, Colliery Locomotives, Rainhill Trials, Steam Locomotives, 1830-1920, Mountain Locomotives, Electric Locomotives, Engine Details, Boiler Details. In the Rolling-stock Section there will be found the following items: Railway Carriages and Wagons, Mono-rail Vehicles, Horse Tramway Cars, Electric Tramway Cars, and Rolling-stock Details. In short, the catalogue, like the exhibition, includes all kinds of railway and tramway locomotives and vehicles for passengers and goods.

Excellent illustrations in half-tone, printed on plate paper, form an outstanding feature. The pictures include Blenkinsop's locomotive, *Puffing Billy*, *Locomotion*, *Royal George*, *Rocket*, *Sans Pareil*, *Novelty*, and other locomotives of early days, together with some of more recent years. Among the rolling-stock illustrations is one of a quarry truck on rails dated 1734, and another of "The First Railway Carriage, 1825." The latter is of a model of the *Experiment*. A second-class carriage, 1839, and a third-class carriage of 1840 afford a striking sidelight on how our grandfathers, or great-grandfathers, travelled by railway.

Mr. Forward is to be congratulated upon the excellent merits of his workmanship.

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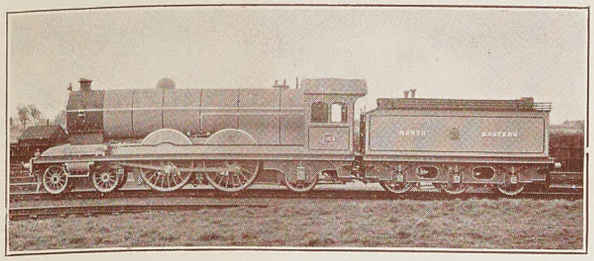
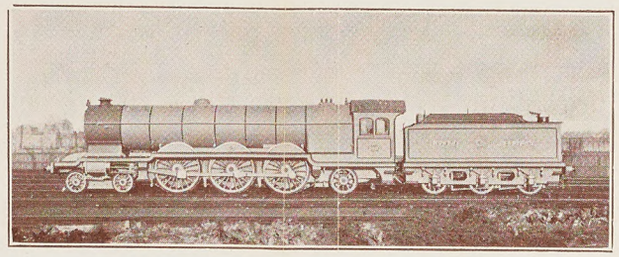
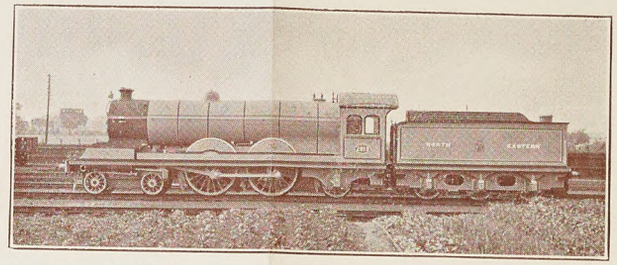


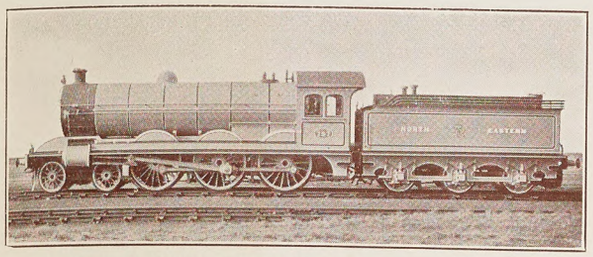
1. Three-Cylinder 4-4-2 Express Locomotive.



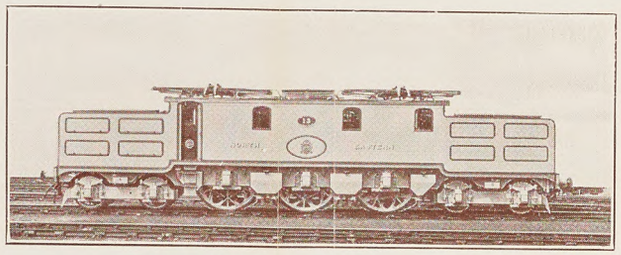
2. Three-Cylinder 4-6-2 Express Locomotive.



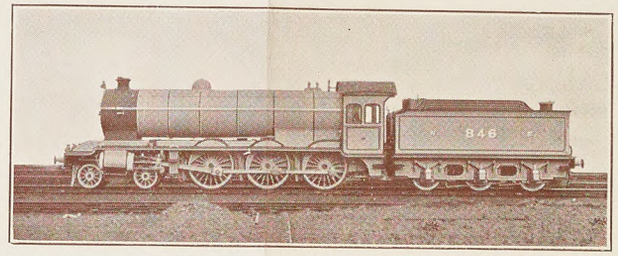
3. Three-Cylinder "Uniflow" 4-4-2 Express Locomotive.



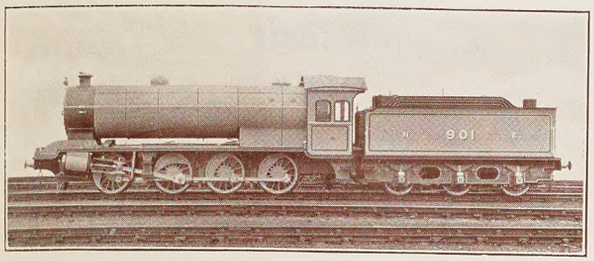
4. Two-Cylinder 4-6-0 Mixed Traffic Locomotive.



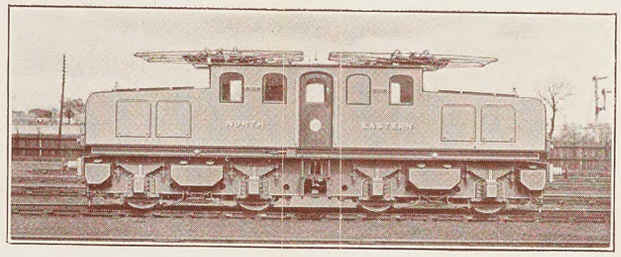
5. 4-6-4 Electric Express Locomotive.



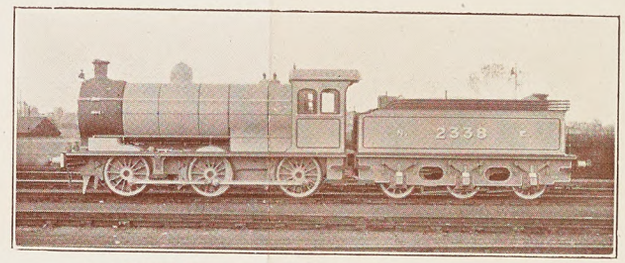
6. Three-Cylinder 4-6-0 Express Goods Locomotive.



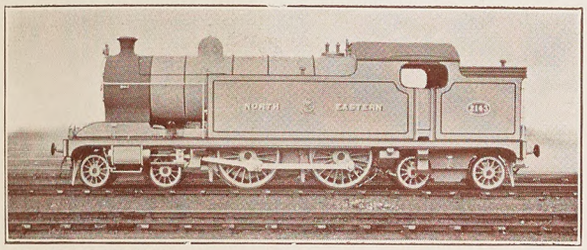
7. Three-Cylinder 0-8-0 Mineral Locomotive.



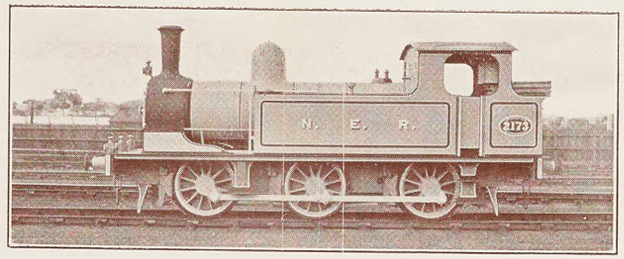
8. 0-4-4-0 Electric Freight Locomotive.



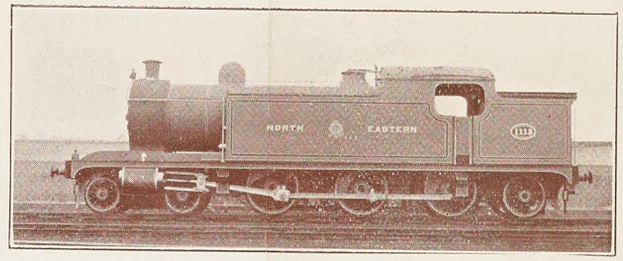
9. Two-Cylinder 0-6-0 Goods Locomotive.



10. Three-Cylinder 4-4-4 Tank Engine.



11. 0-6-0 Shunting Tank Engine.



12. Three-Cylinder 4-6-2 Tank Engine.

Locomotives designed by SIR VINCENT RAVEN, K.B.E., Chief Mechanical Engineer, North Eastern Railway, 1910-1922.

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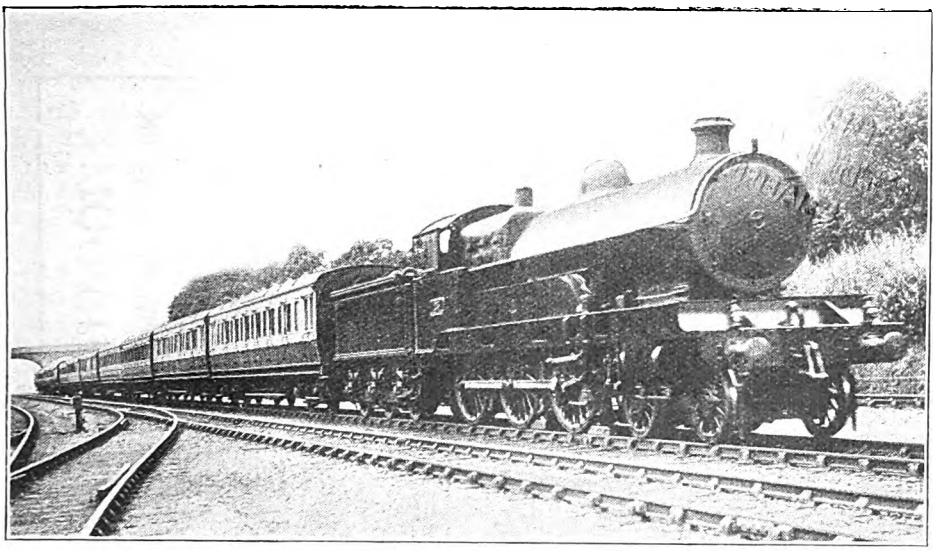

Photo.] [*Henry L. Salmon.*

12 NOON UP LIVERPOOL RESTAURANT CAR EXPRESS.

London and North Western four-cylinder 4–6–0 Locomotive, No. 28.

Notable Railway Stations and their Traffic.

LIME STREET, LIVERPOOL, LONDON MIDLAND AND SCOTTISH RAILWAY.

By J. F. GAIRNS, M.I.Loco.E., M.Inst.T.

THE City of Liverpool takes its place as one of the three largest and most important centres of trade and industry (next to London) in the British Isles, but the greater part of the rail traffic which it occasions is dealt with at three principal railway termini, Lime Street, Exchange and Central. The two former now belong to the London Midland and Scottish Railway, which also has an important interest in the third by virtue of its one-third share in the Cheshire Lines Committee, and on account of which the greater portion of Midland Division Liverpool traffic is there dealt with. In addition to traffic at the termini, the London Midland and Scottish Railway has a considerable number of suburban stations in the Liverpool district, and seeing that it takes so large a share in both the residential, commercial and long-distance traffic associated with Liverpool, it follows that both of its own stations are busy centres of traffic on a considerable scale, which also applies to the Central station, though only part of the traffic there dealt with is L.M. & S.

Liverpool has also played an important part in the historical aspects of railway development in the British Isles. This aspect was, however, very fully covered in Mr. Basil Mercer's article published in the September, 1914, number of the RAILWAY MAGAZINE, on "The London and North Western Railway and Liverpool," and to a lesser extent in the late Rev. W. T. Lawrence's article on Lime Street station, published in the June, 1905, issue. The latter, included in our earlier "Notable Railway Station" series of articles, covers in large measure the same subject matter as the present contribution. There have been, however, many traffic developments and other changes during the years which have

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elapsed since that article was published, though, in the main, the station itself is but little altered, while the importance which attaches to Lime Street station, and the numerous interesting features of its traffic, justify further reference from a somewhat different point of view.

The original Liverpool terminus of the old Liverpool and Manchester Railway was at Crown Street, near Edgehill, but on the branch which now leads to the Wapping Goods Depot. As opened in 1830, therefore, the station was some distance from the more central parts of the City, and one of the earliest developments was the extension from Edgehill to Lime Street, opened on August 15, 1836. Construction of this extension included a tunnel, mainly through rock, about a mile in length, and in view of the gradient —1 in 88 for the most part—was worked, until 1870, by cable haulage. The extension brought the railway, however, right into the City, with the result that Lime Street station is splendidly situated from the point of view of residential and business traffic, and although it is some distance thence to the landing stage and other riverside parts of the City, transit to and from the station in all directions is easy and convenient.

Even in the 'eighties, the growing traffic dealt with at Lime Street indicated the need for increased facilities, and in order to provide two further lines of rail, the greater portion of the tunnel was opened out and converted into cutting accommodating four tracks. These were brought into use in 1890, and as the station, already enlarged at least once, was further extended at the same time, Lime Street was well fitted to meet traffic demands for several years ahead. Now, however, it suffers seriously from traffic congestion, and operation is at times complex and difficult. There is, indeed, urgent need for further enlargement and modernisation, though it is difficult to see how improvement on these lines is practicable. Extension towards the river is impossible, as the station already comes as close to Lime Street as the well-known Lime Street Station Hotel (opened in 1871) will permit, while enlargement to either side is complicated by the close contiguity of adjoining thoroughfares and by the restricted conditions which apply at the northern end.

The exit conditions constitute, indeed, the crux of the situation, in that difficulty is experienced in dealing with long trains, owing to the limited space available for making the required track connections, in view of the fact that between the station and the open cutting up to Edgehill the line is in tunnel (one containing three running lines and one siding road, and the other for a single line) which is entirely built over. Consequently, operation at Lime Street station is often complicated by limited platform length, and by the fact that so many connections have to be made in a short distance that movements affecting certain lines frequently conflict with those on adjoining tracks. So much so, in fact, that it is at times necessary to load up important trains in two sections, combining them just before starting time, while lengthy arriving trains may need division to bring rear vehicles to a platform. At other times, too, although it may be possible to deal with a train as a complete unit at one platform, it extends so far that it interferes with movements to or from one or more other platforms, or with shunting and engine movements which should be able to proceed concurrently. Despite these difficulties, however, traffic at Lime Street is dealt with on a competent basis, and a very large traffic, both long-distance and local is conveyed, aggregating some 500 trains daily at its 11 platforms, and used by about 150,000 passengers, season-ticket, ordinary and excursion.

Lime Street station is, as already pointed out, admirably situated from the point of view of passengers. The frontage of the hotel, itself an architecturally notable block of buildings, forms the greater part of one side of the island site occupied by St. George's Hall, with the Walker Art Gallery and the Picton Library as other adornments of this spacious and relatively open location. A number of main thoroughfares meet close to the station, while electric tram cars on various routes pass the hotel and station entrance. From the road the station itself is largely hidden from view by the hotel, except that the great arched roof with glazed screen (on which the name of the station appears in huge letters) over the newer

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GENERAL VIEW OF LIME STREET STATION HOTEL.

portion on the arrival side, can be seen from various directions over the roofs of shops and other buildings along Lime Street to the east of the hotel.

The main entrance is between the hotel and these buildings, except that, for cab and road traffic, this is chiefly the exit from the station, departing traffic being dealt with on the up side, where a covered yard, known as the "Colonnade" yard, provides accommodation for cabs arriving from the City and for other road traffic dealt with on that side. There is also a further entrance on the down side from Skelhorne Street, but this is not used by passengers, as it is concerned only with the work of the parcels offices, milk traffic, &c.

The main entrance provides a wide roadway, with footways, leading to two roads, one between Platform No. 6 and "E" siding line, a track used for goods traffic of a special character (of which more anon), and the other serving Platforms Nos. 7 and 8. These three platforms are used for the principal arriving and departing expresses, in view of their cab road facilities. Behind Platforms Nos. 1-6 is a somewhat restricted circulating area with booking offices behind the buffer stops of Nos. 1 and 2, 3 and 4, and 5 and 6 (in each case with middle lines), while a large Benn and Cronin train indicator is now provided in the centre of the circulating area. Opposite these are the hotel premises, along the walls of which, and in some cases extending into the hotel buildings, are the ordinary refreshment rooms, bookstall, &c., together with the station entrance to the hotel. In the corner, opposite the end of No. 1 platform, are the station dining rooms (extending into the hotel block), and at the side the cloak and luggage offices.

Along No. 1 platform, forming the boundary of the station proper, is a range of waiting rooms, with stationmaster's office, telegraph office and staff offices. Now that Lime Street is a "closed" station, these are separated from the platform by a somewhat narrow railed-off passage way. Above these buildings are the offices of the District Superintendent. On the down side of the entrance from Lime Street are Platforms Nos. 7-11. Whereas Nos. 1-6 have separate entrance gates, these are reached via an inner circulating area controlled by two ranges of gates parallel to the roadway, except that No. 11 is further railed off in view of its general reservation for parcels, milk and other traffic dealt with by road vehicles using the Skelhorne Street entrance, as already mentioned. Such traffic is therefore kept clear of the general work of the station. Adjacent to this entrance are the offices and premises of the carted luggage and parcels department, with an office

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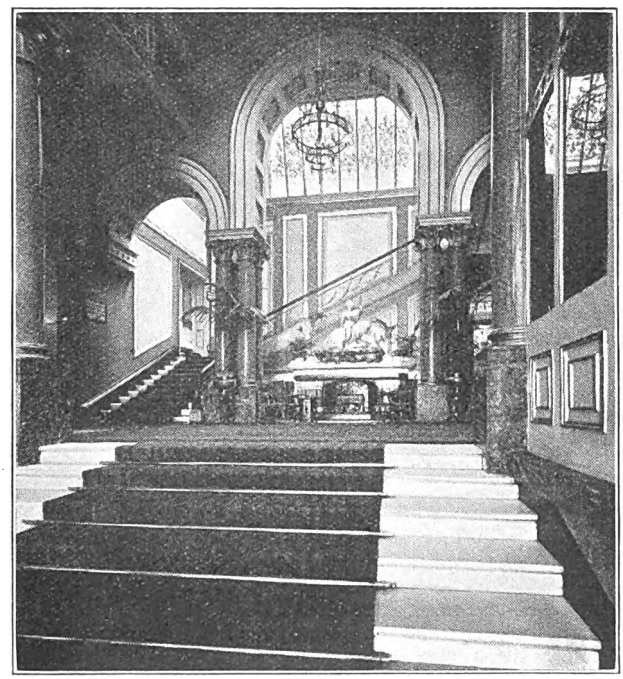
entrance from the Skelhorne Street yard. Along the inner circulating area mentioned are offices for ticket collectors and other staff sections.

Behind No. 1 platform is a short platform, known as the "Back Road," at one time used for Bootle branch trains, but now, owing to its short length, employed only for loading or unloading vehicles engaged in meat, fish, yeast and other miscellaneous traffic, together with horseboxes, &c., the "Colonnade" yard providing convenient road access therefor clear of the other work of the station. Beyond the "Back Road" is a 50 ft. turntable, operated electrically, with two short engine spurs. No. 1 (675 ft.) and No. 2 (670 ft.) platforms come close together near their exit ends, but for the greater part of their length have a middle road between. No. 3 (687 ft.) and No. 4 (693 ft.) also have a middle road between, but have the great disadvantage that all three lines converge before the ends of the platforms are reached, so that full length can only be used at the expense of blocking the other lines concerned entirely. No. 5 (693 ft.) and No. 6 (655 ft.) enclose two middle lines of limited length. The respective middle lines so far referred to are known, respectively, as "A," "B," "C" and "D" sidings.

"E" siding, which comes next, is generally used for banana vans, of which considerable numbers are handled at the station. Much of this traffic comes from the Garston docks to Lime Street station by rail, and is here unloaded, the availability of the cab road rendering this the most convenient place for this work. The siding is also used for loading or unloading mails and parcels post, and occasionally for dealing with special goods traffic which is most conveniently handled in the passenger station. No. 7 platform is alongside "E" siding, while Nos. 8 and 9 and 10 and 11 platforms form remaining pairs. There are no middle lines in this part of the station, except that two short horse docks are let into the platform between Nos. 7 and 8, which have road facilities.

At the exit end of the station all lines converge into four tracks, the connections beginning very close to, if not within, the platform ends. Passing under a wide road bridge in advance of the four-track tunnel, with the signal cabin in the centre, the four lines are allocated as follows: "down slow," "down fast," shunting neck, and "up fast." The "up slow" line is in a separate tunnel which commences just beyond the signal cabin. Owing to the restricted space available, only platforms 1-5 and sidings "A," "B," "C" and "D" have access to the "up slow" line, while other connections are so complex that a certain amount of "permissive" working has to be allowed. In fact, this is usual with trains arriving for Platforms Nos. 1-4, these being hand-signalled beyond the signal cabin by signalmen under the control of inspectors on the ground. These are, however, chiefly empty coach trains, and the main inconvenience thus occasioned is that the old system of departing trains on one side and arriving trains on the other is thus enforced.



ENTRANCE HALL, LIME STREET STATION HOTEL.

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This means that many trains have to be shunted across after arrival, but this operation is often carried out by utilising gravity, empties being propelled from the station to the shunting neck, or to the "up fast" line, and allowed to return by gravity under brake control, while the engine runs to another road or proceeds to the 50-ft. electrically operated turntable on the up side or to the 60-ft. hand-operated turntable on the down side. There is a lack of standing space for engines, but most of the tank engines are scheduled to leave again as soon as possible, or can be placed on a siding road, while the tender engines usually require to run to one or other of the turntables.

The signal cabin has 135 levers, and is manned by three men between 6 a.m. and 10 p.m., and by two men between 10 p.m. and 6 a.m. These men do their own booking. In view of the complex working three "tunnel mouth inspectors" divide the day between them, one always being stationed near the signal cabin and supervising the movements in and about the station very closely. In the case of all movements for which full signalling is not provided (speaking generally, such movements are never made with trains conveying passengers), trains require to stop at the signal cabin and proceed only on the instructions of the inspector. Otherwise, arriving trains are controlled by route-indicating signals (which have replaced the old bridges of signals) near the further end of the four-track tunnel. Although the signalling is somewhat old-fashioned, it is as complete as practicable, most movements being made under the direct control of either running, shunt or disc signals, the inspectors taking special charge of any other movements which may be necessary. The shunting neck will take 25 six-wheeled vehicles, and at times it is practicable to stable one or two sets there. Shunting gongs are provided here and there as required. Several platforms have track indicators in the signal cabin to show track occupancy, and a few special measures are adopted to cover particular operations, such as the linking together of levers 74 and 75 when sleeping-cars off the night trains are placed at the outer end of "E" siding line between the time of arrival and 8 a.m.

With regard to traffic at Lime Street, it will be best to consider the summer arrangements, as these involve use of station accommodation to fullest capacity. Definite platform allocation is made, and this depends upon the lengths of trains and whether they are clear of, or interfere with, movements on other lines, as will be seen from the following notes concerning the more important long-distance departures.

a.m.		
12.45	No. 6.	Glasgow (sleeping-car), Edinburgh, Barrow, &c.
1.25	No. 6.	Chester newspaper express.
2.30	No. 7.	Crewe, Birmingham, &c.
7.55	No. 4.	Manchester, Huddersfield, Leeds.
8.0	No. 2.	London Restaurant Car Express.
8.15	No. 6.	Morecambe stopping train (conveys milk empties for Lancaster and Morecambe).
8.35	No. 4.	Manchester, Huddersfield, Leeds and Newcastle.
9.0	No. 7.	Manchester, Huddersfield and Leeds.
9.10	No. 3.	Shrewsbury, Bristol, Plymouth (restaurant car), Swansea, &c.
9.45	No. 2.	London Restaurant Car Express.
10.0	No. 3.	Crewe, Wolverhampton and Birmingham.
10.25	No. 3.	Crewe, Stoke, Derby and Nottingham (Midland Division engines and vehicles).
10.30	No. 2.	Crewe, Bristol and Plymouth (restaurant car); conveys also "Sunny South" vehicles for Brighton and Eastbourne, and for Margate and Ramsgate.
10.50	No. 4.	Chester, with through vehicles for Bangor, Portmadoc, Llandudno, Holyhead, &c.
11.0	No. 6.	Manchester, Leeds, Huddersfield and Hull.
11.5	No. 7.	London Restaurant Car Express.
11.35	No. 11.	Milk empties for Whitchurch and other destinations.
noon		
12.0	No. 7.	Crewe, Aberystwyth, Swansea, Taunton (restaurant car), Birmingham, London, &c.
p.m.		
12.45	No. 11.	Milk empties for Chester, &c.
1.0	No. 3.	Manchester, Leeds, Huddersfield, &c.
1.40	No. 6.	Chester, Rhyl, Llandudno, Pwllheli, Holyhead.
2.0	No. 7.	London Tea Car Express.
2.15	No. 5.	Express (L. & N.E. vehicles) to Manchester, York and Newcastle.
2.45	No. 5.	Crewe, Birmingham, Bristol and G.W.R.
3.0	No. 1.	Manchester and Leeds.
4.0	No. 3.	Manchester and Leeds (L. & N.E. vehicles).
4.5	No. 2.	London Restaurant Car Express Birmingham, &c.

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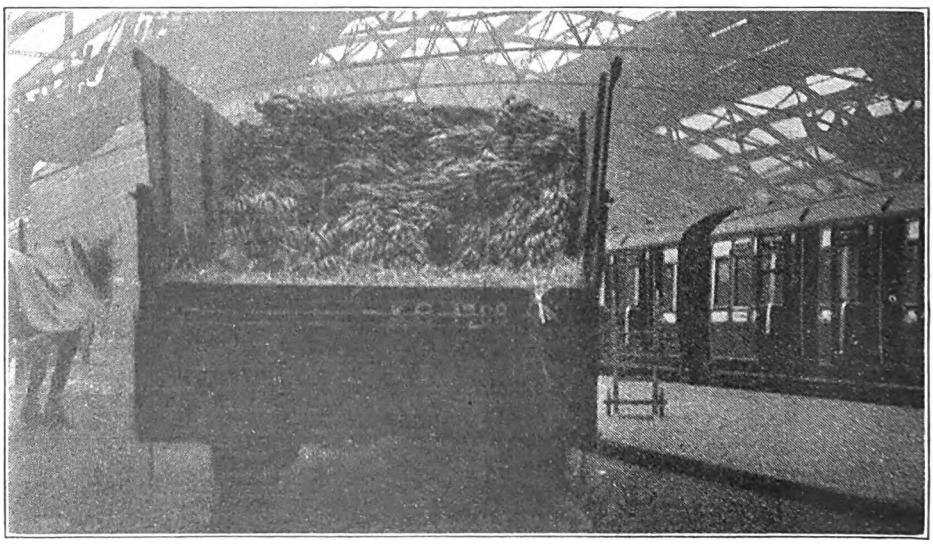
p.m.		
4.15	No. 7.	Club Car Express to Llandudno, Pwllheli, Holyhead, &c.
5.0	No. 5.	Manchester, Huddersfield and Leeds.
5.20	No. 7.	London Restaurant Car Express, Birmingham.
5.45	No. 7.	Manchester, Huddersfield and Leeds.
6.5	No. 3.	(Thursdays only.) Return Windermere excursion.
7.0	No. 6.	Manchester, Huddersfield and Leeds.
7.5	No. 2.	Crewe, Birmingham, Shrewsbury, Bristol, Aberystwyth.
7.15	No. 3.	Wigan stopping train (including Furness section vehicles).
8.25	No. 3.	(Saturdays only.) Return excursion for Carnforth.
9.30	No. 5.	Chester and Holyhead.
10.0	No. 6.	Express for Crewe, Stoke, Birmingham, London (mails), and parcels, &c., van for Southern Railway, &c.
10.40	No. 6.	Manchester and Huddersfield mail train. Passengers to Widnes and Warrington only.
10.55	No. 4.	Chester and Holyhead mail train.
11.50	No. 7.	London Sleeping Car Express, with sections for Cardiff, Penzance and various vans.

Besides these trains there are the additional Manchester expresses required to complete the hourly service of Liverpool and Manchester expresses, together with locals to Garston Docks, Alexandra Dock, Canada Dock, St. Helens, Widnes, &c., and stopping trains to Crewe, Manchester, Chester, Wigan, &c., in some cases by more than one route. Arrivals include corresponding return services from London, the West of England via the Hereford Joint line, North Wales, Chester, Birmingham, &c., from Yorkshire, and from the North and Scotland, besides the locals, which bring in large numbers of passengers from the residential districts. In addition to the passenger trains there are considerable numbers of empties travelling between Lime Street and the various depots, and some of these complicate working considerably. On Sundays there are about 24 trains leaving Lime Street, and the same number arriving. These include the 8.40 a.m., 1.0, 3.55 and 10.50 p.m. London trains, and the 10.40 a.m. restaurant car express for Bristol and Plymouth.

It is only to be expected that at so important station there will be a considerable staff. On the operating side this is under the control of Mr. J. E. Knowles, stationmaster, who is assisted by three assistant stationmasters, Messrs. R. Evans, P. Kilshaw and C. Potter. Under them are 3 tunnel mouth inspectors, 3 departure inspectors, 3 arrival inspectors, 5 tunnel mouth foremen, 2 platform foremen, 8 signalmen, 2 foremen ticket collectors, 27 ticket collectors (also 3 junior collectors),



TRANSFERRING BANANAS BETWEEN ROAD VANS AND RAILWAY VANS ON "E" DOCK LINE.

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30 platform porters, 5 parcels foremen, 5 leading parcels porters, and 40 parcels porters. There are 3 clerks in the stationmaster's office, a chief staff clerk, an assistant staff clerk, and 3 timekeeping clerks; also 1 cloakroom clerk and 8 cloakroom attendants and porters, while the lost property office has 2 porters; 30 guards attached to the station and a few other employees (including 2 foremen shunters at Edgehill) bring the total to about 265.

The booking office staff is under Mr. Green, and includes 14 booking clerks and five accounts clerks. In the case of passengers arriving by transatlantic and other liners at Liverpool (landing stage), tickets are issued by the steamship companies, but Mr. Green has oversight of this, as also of bookings at the Riverside station.

The parcels department is under Mr. Mawdsley, his offices being above the platform premises near No. 11 platform (where also are Mr. Green's offices), and adjacent to the Skelhorne Street entrance. Besides his own office staff, Mr. Mawdsley has control of 21 van men and 21 van boys. For the work of his department there are four motor vans and 21 horse vans. A public parcels office is provided alongside the main entrance, below the hotel. During a normal year some 300,000 cans of milk are handled at Lime Street, 9,000 tons of fish, 8,000 tons of other traffic, and about 1,600 horses, besides upwards of 1,100,000 parcels.

As showing the volume and value of traffic dealt with at Lime Street, it may be mentioned that upwards of 1,000,000 passengers are *booked* annually, and the total receipts aggregate about £670,000. These figures take no account of arriving or through booked traffic, nor of the journeys made by some 1,500 holders of season tickets issued from Lime Street and the far greater number available thereto. As might be expected, the busiest days of the year are those immediately prior to August Bank Holiday, while Lime Street is affected by the summer pressure, as in the case of other busy centres. It is, however, in large measure, an all-the-year-round station, in that the bulk of its traffic is residential or of a commercial character.

MR. J. E. KNOWLES,
Stationmaster,
Lime Street, Liverpool.

Mr. J. E. Knowles, stationmaster, commenced as a booking clerk at Newton-le-Willows in 1893, afterwards serving in a similar capacity at Wigan and St. Helens. He was then appointed accounts clerk at Wigan, soon after being transferred to the staff department of the District Superintendent's office. In 1899 he was appointed a relief stationmaster, and in 1901 became stationmaster at Middlewich. In 1904 he became District Traffic Inspector at Bolton, going to Crewe in a similar capacity in 1905. He then became Headquarters Traffic Inspector, first at Rugby and then at New Street, Birmingham. When Crewe was made a central control centre, Mr. Knowles was appointed Head Controller, subsequently becoming Chief Controller and Yardmaster at Basford Hall traffic yard, Crewe. In 1921 he came to Lime Street as stationmaster.

In conclusion, the writer has to acknowledge the courteous assistance in the collection of information concerning, and facilities for observing, traffic and working at Lime Street, rendered by Mr. C. R. Byrom, General Superintendent (Passenger Commercial) and Mr. R. O. Squarey, Acting District Superintendent; by Mr, Knowles, Messrs. Green and Mawdsley, and others.

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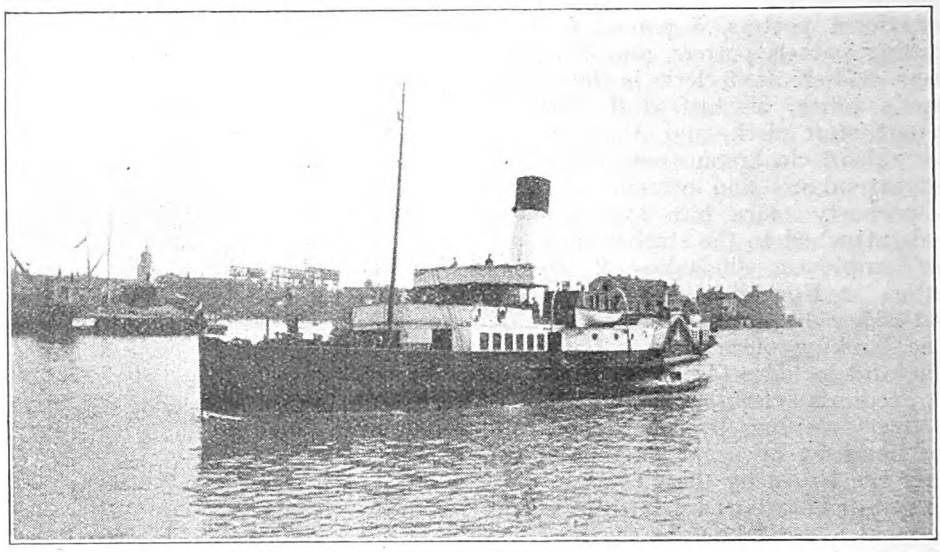

SOUTHERN RAILWAY S.S. "DUCHESS OF FIFE" ENTERING PORTSMOUTH HARBOUR.

The Isle of Wight and the Southern Railway.

By G. W. TRIPP, A.C.G.I., A.M.Inst.C.E., M.I.Mech.E.

THE taking over of the Isle of Wight railways by the Southern Railway will no doubt result, in due course, in the provision of improved facilities for travel in the island, and many changes. But the state of affairs just before the island railways lost their identity, and during the transition period, should certainly be placed on record. This is the purpose of the present article, as well as to indicate briefly some of the problems with which the new organisation is confronted, and to suggest some of the developments likely to be productive of good.

Clearly to understand the situation the general scheme of railway lines in the island must be appreciated, and although this could perhaps be gleaned by a careful perusal of articles that have already appeared in these pages, as most of them are now out of print, a passing reference is probably desirable. To simplify matters, the fact that the Ryde Pier Railways have always been a part of the mainland systems (being jointly owned by the London and South Western and the London, Brighton and South Coast Railways, although worked by two of the island lines) will be ignored, having been once mentioned to avoid possibility of an inaccurate conception, and the short length of line concerned will be considered as coming within the orbit of the working companies.

There are then left the three main companies: (1) the Isle of Wight Railway, (2) the Isle of Wight Central Railway, and (3) the Freshwater, Yarmouth and Newport Railway. Each of these is distinctive in character and each has its own difficulties and problems.

The Isle of Wight Railway can certainly be regarded as the "premier line" of the island, although not the largest as regards mileage, &c. It does, however, serve the most densely populated area, although it does not touch the capital. It is the oldest line, and is noted for its comfortable passenger stock, and its locomotives are of a standardised type, looking very smart in their livery of "Midland" red and with their bright brass work. Indeed, the whole line gives the impression of prosperity. It is fortunate in being primarily a main line, serving the towns of Ryde, Sandown, Shanklin and

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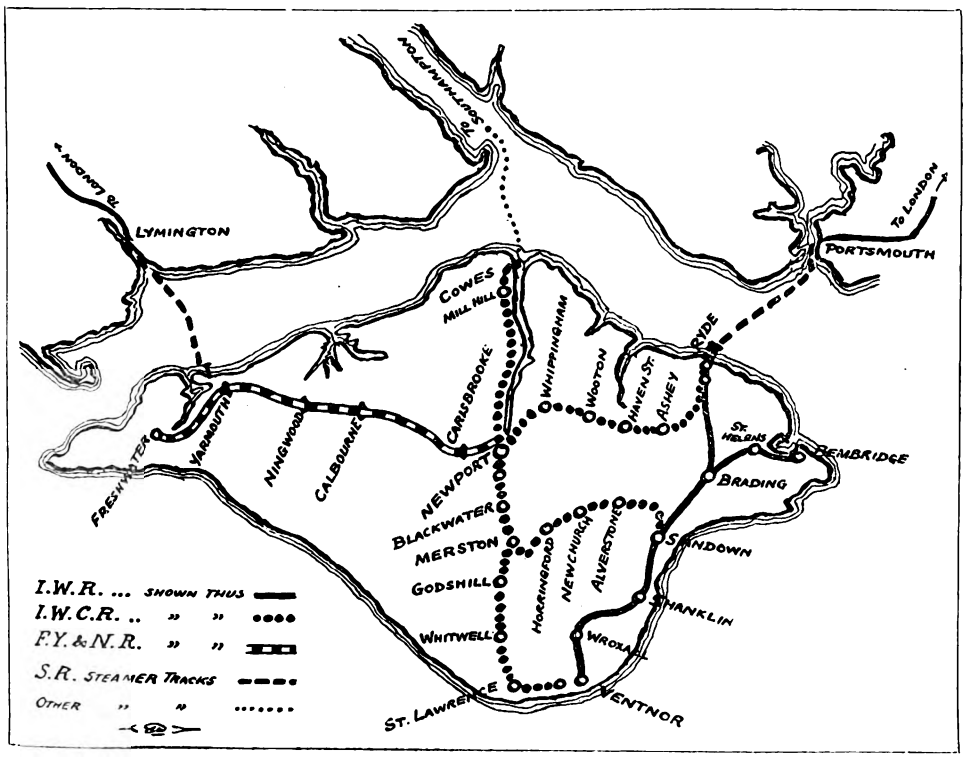
Ventnor, and with only one short branch line along the valley of the old Brading Harbour to Bembridge.

The Isle of Wight Central Railway, on the other hand, is most varied in character, and, although it serves Newport and the seaport of Cowes, it also has a large agricultural area to cater for, where the population is small. It cannot claim standardised locomotives or passenger stock, and many of the units have already done duty in the suburbs of London. Again, this railway cannot be said to possess a main line, for it radiates from Newport in three directions, north, east and south—speaking approximately—each of the lines being of importance, the area of densest traffic being that of Newport–Cowes, including also the important goods traffic at the wharves of the Medina. It is via its Newport–Ryde line that a large part of its mainland traffic is derived, and these services are likely to be developed under the auspices of the Southern Railway, seeing that the connection between Cowes and Southampton is maintained by a separate steamship company, whose very notices are none too assuring, stating that the connections between the steamer and railway cannot be guaranteed. As a matter of fact, failures are very unusual, as the Southampton steamers are mail carriers, thereby preventing the trains being despatched from Cowes regardless of consequences.

The remaining line of the Central Company is that from Newport to Sandown, with its branch from Merstone Junction to Ventnor Town (renamed by the Southern Railway Ventnor West). This is of importance in that it links the western end of the Island with the important town of Ventnor, and also with Sandown, where access is available via the Isle of Wight Railway to Shanklin, Bembridge, &c. This line is the longest section of the Central system, it being 9 miles from Newport to Sandown.

The Freshwater, Yarmouth and Newport Railway differs from both the others in many respects, among which may be instanced, first, that it has no branches, but consists of a main line, 12 miles long;



MAP OF ISLE OF WIGHT RAILWAYS (WHEN INDEPENDENT).

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GENERAL PARTICULARS OF ISLE OF WIGHT RAILWAYS.

Railway.	Date opened.	Mileage.	Number of		
			Loco-motives.	General Passenger Vehicles.	Goods Vehicles.
I.W.R.	1864	14¼	8	57	227
I.W.C.R. ..	1887	28½*	11	53	316
F.Y. & N.R. ..	1889	12	2†	12	31

* Including the Newport, Godshill and St. Lawrence Railway.
† Also a rail motor.

TRAIN FACILITIES OF RESPECTIVE RAILWAYS.

Railway.	Service.	Number of Passenger Trains.			
		Before Absorption.		In Transition Period.	
		Weekday.	Sunday.	Weekday.	Sunday.
I.W.R.	Ryde—Ventnor	10	4	13	5
I.W.C.R. ..	Newport—Cowes	12	7	25	9
	Ryde	8	6	14	6
	Sandown	6	3	8	4
	Ventnor	5	2	4	0
F.Y. & N.R. ..	Newport—Freshwater	5	2	7	4

SOUTHERN RAILWAY STEAMERS ON ISLE OF WIGHT ROUTES.

Name.	Date Built.	Gross Tonnage.	Dimensions.		Service.
			Length.	Beam.	
			ft.	ft.	
Duchess of Albany ..	1889	256	170	22	Portsmouth—Ryde.
Duchess of Fife ..	1899	443	215	26	Ditto.
Duchess of Kent ..	1897	399	195	26	Ditto.
Duchess of Norfolk ..	1911	381	190	26	Ditto.
Princess Margaret ..	1893	260	170	22	Ditto.
Lymington	1893	130	120	18	Lymington—Yarmouth.
Solent	1902	161	135	20	Ditto.

(1) Ryde to Portsmouth and Southsea (and for a number of years a short sea passage to Stokes Bay);
(2) Cowes to Southampton; and
(3) Yarmouth to Lymington.

For comparison a typical Southampton Company's steamer :—

Duchess of York ..	1896	302	185	22	Southampton—Cowes.

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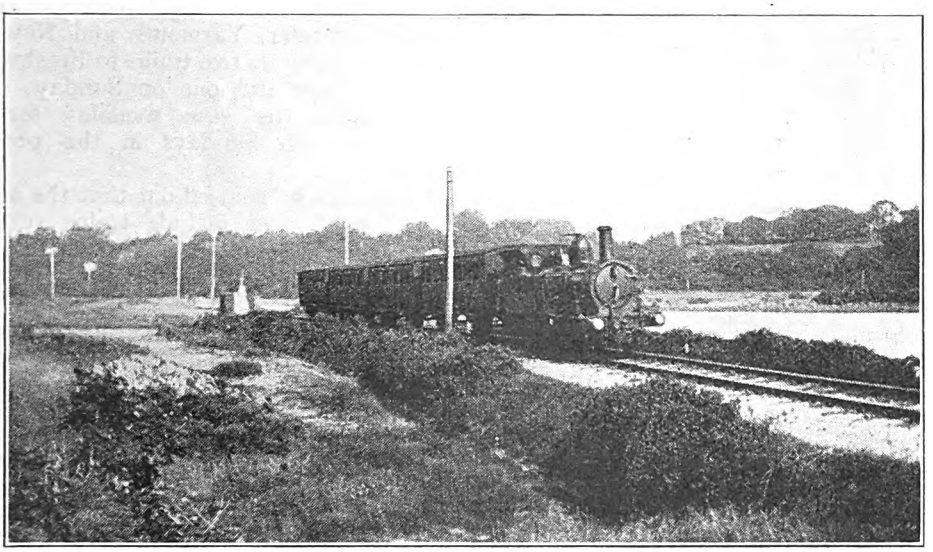
secondly, it has no important town on which to rely for traffic after Newport has been left behind; and, thirdly, it has no direct connection with the mainland, for, although the map might appear to suggest that the services from Lymington to Yarmouth would form a convenient means of reaching points on this railway, the station is at a considerable distance from the pier; while, furthermore, a coach service between Freshwater and Yarmouth has been in operation for many years, and is undoubtedly the most convenient way of reaching the western end of the island.

As an indication of the number of potential patrons of the railway to be found inside the island, apart from the important seasonal influx of visitors, the following populations of the principal towns may be of interest: Ryde, 11,295; Newport, 11,036; Cowes, 9,998; Sandown, 7,664; Shanklin, 7,374; Ventnor, 6,063; Freshwater, 3,192. From the most recent returns available the population for each mile of railway for the three lines concerned works out approximately as follows: Isle of Wight, 2,941; Isle of Wight Central, 1,837; Freshwater, Yarmouth and Newport, 1,341. If Newport were eliminated from the last mentioned line, the figure would drop to 422! The whole of the railways are single line, with the apparent exception of that from Ryde Pier to the point south of St. John's Road, where the Isle of Wight and Isle of Wight Central Railways diverge, but the lines from St. John's Road are not treated as up and down roads, but each set of rails is used exclusively by one distinct company.

In the days that are now past there has always been a degree of competition between the island railways, although not of a *purely* local character, it being rather the attempt of each to secure as much as possible of the traffic from London and the mainland generally. Perhaps the best example is the spirited bid of the Central line to secure a portion of the remunerative London–Ventnor traffic, which the Isle of Wight Railway had regarded as a monopoly prior to the opening of the Godshill and St. Lawrence Railway, an independent concern, although always operated by the Isle of Wight Central Railway, which afforded an alternative route to Ventnor. The Central Railway announced an express service between London and Ventnor Town in 4¼ hours, "by the direct route via Southampton and Cowes, with two changes only—Southampton and Cowes," the notice going on to state that the "trains run alongside the boats at Southampton" and that there was "free transfer of luggage between the trains and boats at Southampton and Cowes."



ISLE OF WIGHT RAILWAY.
Bembridge Branch Train.

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One further example of competition, but of rather a different nature, may be given. This was primarily between the London and South Western and the London, Brighton and South Coast Railways for the passengers to Freshwater and Totland Bay. This traffic had been entirely in the hands of Waterloo prior to the opening of the Freshwater, Yarmouth and Newport Railway in 1889, but when this became a *fait accompli* the Brighton line seized the opportunity to develop a new service, and the fact that the new railway was operated by the Central line made it possible for through trains to be run from Ryde to Freshwater, incidentally the longest through run in the Island.

The Central Railway entered into the spirit of the competition, and provided lengthy destination boards for its coaches, displaying the fact that "London to Freshwater in four hours" was a possibility. They also christened it "The favourite overland route."

When the Freshwater Company broke away from the Central line in 1913 and built its own station at Newport—a dreary single platform—the through trains were discontinued, and greatly as passengers disliked this, they still further resented having to walk from one station to another at Newport, and the service suffered in consequence.

It is true that latterly the Freshwater trains were run into the Central station for the use of through passengers, and under the auspices of the Southern Railway this route will probably flourish again—not as a rival, but to supplement the service via Lymington.

Before leaving the past a few particulars regarding the three railways may be of interest, and in order to eliminate the effects of war, but also to include the Freshwater, Yarmouth and Newport Railway as a separate entity, the year 1914 has been taken as typical, the figures given being culled from that mine of information—the RAILWAY YEAR BOOK.

For convenience of comparison the statistics are collected on page 264.

Passenger services may be regarded as having had long enough to be normally restored prior to absorption by the Southern Railway, and accordingly the time-table for 1920 has been selected as typical of the past.

The number of trains performing the whole journey between Ryde Pier and Ventnor was nine on weekdays and three on Sundays (compared with pre-war figures of 11 and 4 respectively). The number of journeys possible from Newport to Cowes, Ryde, Sandown and Ventnor were 12, 8, 5 and 3 respectively on weekdays, with 7, 6, 0, 0 on Sundays. This service was distinctly inferior to that obtaining in pre-war days, although the main services to Ryde and Cowes were restored, the former totals of 8 to Sandown and 7 to Ventnor on weekdays (with 3 and 2 respectively on Sundays) being considerably better.

A similar remark might be made about the Freshwater, Yarmouth and Newport Railway, with its five trains to Freshwater on weekdays and one on Sunday, compared with the same weekday service, but three on Sundays in the pre-war period.

It should be pointed out that the above numbers do not include trains running on certain days only, except where there is a train every day, but with a separate timing on Saturday, and all the information given ignores the special service in operation during the height of the summer period.

Having now set out a summary of the past, let us proceed to consider the transition period of 1923, when the Island railways came under the control of the Southern Railway, but still preserved at least a degree of individuality.

The second table on page 264 indicates clearly the approximate averages of the pre-war and post-war periods in contrast with the transition period.

From the foregoing table it will be seen that there has already been a marked improvement, indeed a general increase of over 40 per cent., the most noticeable being the doubling of the number of weekday runs between Newport and Cowes.

Already there are definite indications that the old order is passing, and it may be interesting to chronicle some observed by the author during the autumn.

Several of the Island railway notice boards have been replaced by those of the Southern line, while the notices displayed have been headed "Southern Railway" for some time.

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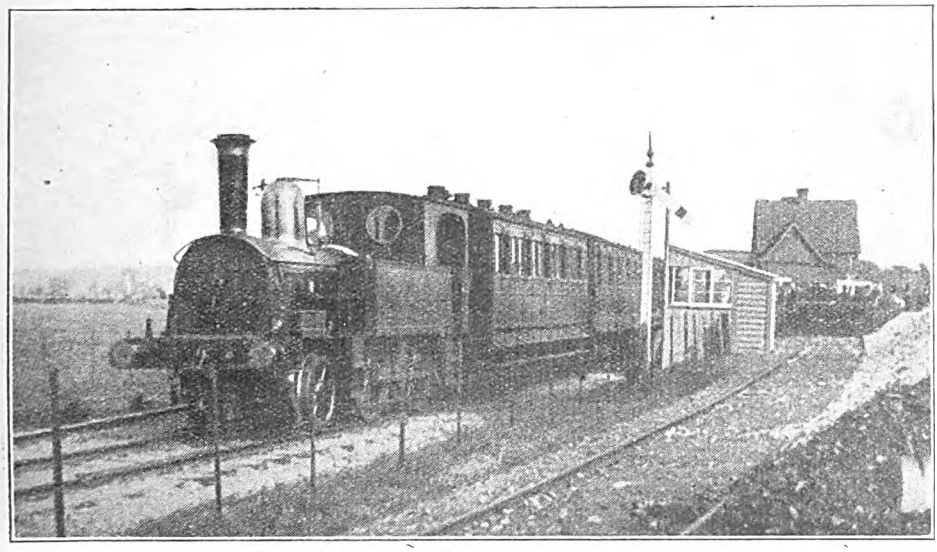
London and South Western 0-4-4 tank engines may be seen on some of the main line trains of the Isle of Wight Railway, still resplendent in their Eastleigh livery, and bearing the letters L.S.W.R. on their side tanks. It is true that it has not been unusual for the other lines to purchase second-hand locomotives from the mainland, a notable instance being the once famous "Terriers" of the L.B. and S.C.R., but one of the first acts of the purchasers has invariably been to paint them in their standard colours, and these serviceable little machines have appeared in the dark red formerly adopted by the Freshwater arrived behind a black I.W.C.R. locomotive.

It may be argued that the foregoing instances, interesting though they are to the railway observer, can hardly be advanced as indicative of general improvements for the travelling public. A closer investigation, however, would show that there are definite gains to be found already, for the bogie coaches already mentioned are certainly the best that have been provided on this route, the third class is very comfortably upholstered and the coaches are electrically lighted.



ISLE OF WIGHT CENTRAL RAILWAY.

Train leaving Carisbrooke (when F.Y. & N.R. was worked by Central Railway).

Central line, also in the black of their later standard, and one was still running in 1923 in the green hue of the Freshwater, Yarmouth and Newport Railway.

That the days of internal competition are past was shown by the harnessing of an Isle of Wight Railway engine to the train from Sandown to Newport, while further evidence of the new order was to be found in the train itself, composed as it was of bogie coaches, painted dark green, and with the inscription "Southern Railway" in large gilt letters over the windows. A still further example of the mixing of stock was witnessed on arrival at Newport, when the train from

It was somewhat amusing to listen to the comments of a party of schoolgirls on the new stock, as they speculated as to the possibility of their returning home by a late train in order to see whether both electric lights were in use!

The Freshwater connection with the evening Sandown train was run to the north side of the Island platform at Newport, obviating the necessity for crossing the bridge; this would have been unheard of under divided control, when the utmost concession on the part of the Central line was to permit the Freshwater trains to use the southern bay at Newport.

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Even as a straw may show the way of the wind, so these little changes may be taken as foretelling more harmonious working and more general efficiency.

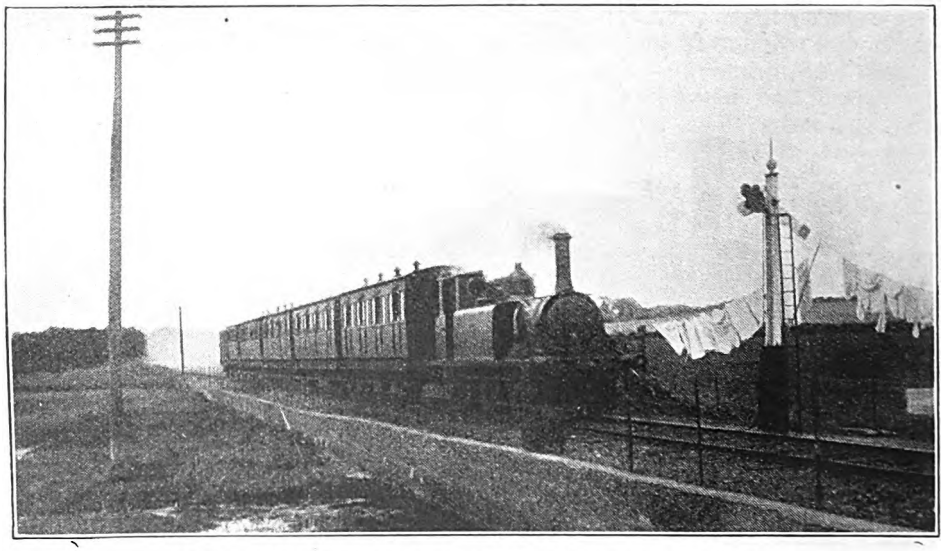
Before investigating future possibilities it is necessary to consider the approaches to the Island. For many years the Island railways have relied upon three main routes for their communications with the mainland :—

(1) Ryde to Portsmouth.
(2) Cowes to Southampton.
(3) Yarmouth to Lymington.

The London and South Western Railway has been interested in all three, whereas its rival—the London, Brighton and South Coast—was only concerned with the services via Ryde, the steamships being the joint property of the two railways. The Lymington boats were owned exclusively by the South Western Railway, but the Southampton steamers were independently owned by a company with the impressive name of Southampton, Isle of Wight and South of England Royal Mail Steam Packet Company.

The average number of passages during the off-season of the year between the Island and the mainland are 24 on weekdays and 9 on Sundays, the total weekly sailings to Portsmouth, Southampton and Lymington being 91, 33 and 30 respectively.

From this it will be seen that the bulk of the passenger traffic leaves the Island by way of Ryde, but in comparing the relative importance of the services from Cowes and Yarmouth it is very misleading to take the number of sailings without bearing in mind that the Lymington boats are very small. It is doubtful whether much larger boats are a possibility, as even now it is difficult enough for them to turn at low tide at Lymington, while as the river is narrow, shallow and winding the solution can hardly be found in big double-ender steamers. It might be mentioned that during the summer months the Lymington steamers continue their voyage to Totland, and the Southampton boats to Ryde and Southsea.



FRESHWATER, YARMOUTH AND NEWPORT RAILWAY.

Freshwater train running beside the River Yar. "Terrier" Locomotive No. 2.

Particulars as to the steamers owned by the Southern Railway will be found in the third table on page 264.

The funnels of the Lymington steamers are the familiar South Western buff, while the joint Portsmouth steamers are white with black tops, similar to the "Brighton" continental boats. Presumably all will soon appear in the new standard of the Southern Railway.

Unfortunately, the Isle of Wight

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cannot boast of many important industries; it is largely agricultural, and the passenger traffic is largely dependent upon the tourist and holiday maker. It is open to question whether a tunnel would be an inducement; indeed, to some it would be a deterrent, the writer frequently having heard remarks to the effect that the holiday commences on boarding the steamer for the Island. The necessity for crossing the water tends to produce that feeling of aloofness from business worries which has so recuperative an effect.

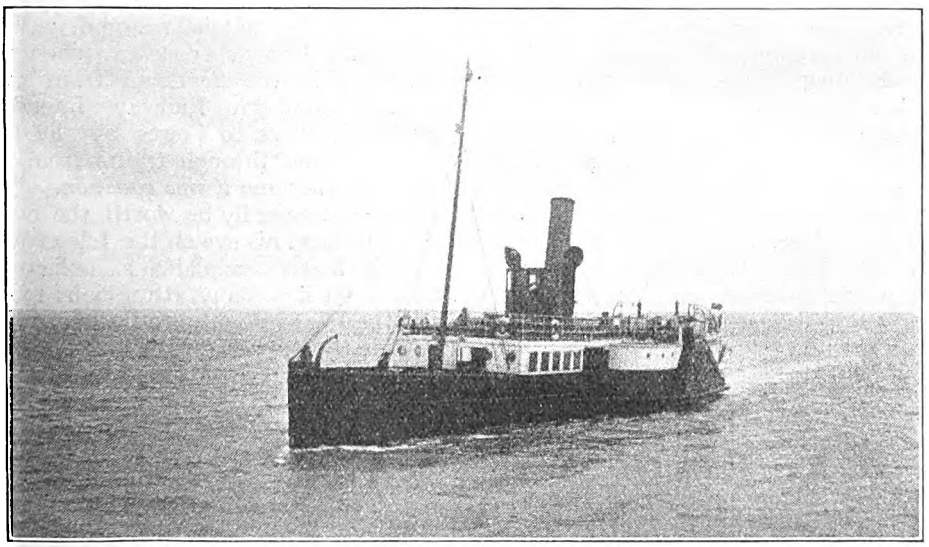
Several problems, none too easy of solution, confront the Southern Railway, two very important ones being to meet satisfactorily increasing motor bus competition; and, secondly, to establish good timekeeping.

The Vectis Bus Company provides a tolerably good service to most parts of the Island, and for purely local traffic is developing into a formidable rival which can only be met by the provision of a more liberal railway service, coupled with cheaper fares and more inducements. This the Southern Railway is realising. Allusion has been made to the increased number of trains, and remarkably cheap tickets are being issued permitting the double journey to be made for the single fare on all trains after 10 a.m., the return being possible by any train the same day, and in a good many cases a break of journey is also permitted. When the high fares in force a few years ago are recalled, the improvement is most commendable.

It will often be found that the railway return ticket is less than a single ticket on the bus, and as an example it may be stated that an excursion ticket from Sandown to Ryde Esplanade and back costs 10d., whereas the double journey by bus would be 2s.

The Island Railways in the past had an unenviable reputation for bad timekeeping, but let those who level the complaint ponder the difficulties, and offer a remedy if they can!

To understand the problem let us follow a sequence of events and see the result. A boat due at Ryde at 9.45 is delayed owing to the train's late arrival at Portsmouth, and so it is nearly 10 o'clock before the pier is reached. By the utmost effort the Central line train is despatched at 10.5, and, without losing any journey time, reaches Newport a quarter of an hour late at 10.35. But a train to Freshwater was due away at 10.25, and it too must be a quarter of an hour late, making it reach its destination two minutes after



SOUTHERN RAILWAY S.S. "SOLENT."

Lymington and Yarmouth Service.

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it is due to have left again on its return run to Newport, with its engine having run round the train, &c.

A more liberal time allowance for turning is not possible, or the train could not be back again in time to ensure connections in the reverse direction. Such is a sketch of the problem!

Obviously by having two engines in steam on the Freshwater line, and utilising one of the passing loops at Yarmouth or Ningwood, it would be possible to obviate the cumulative effect of delays—but at what a price! Not only the cost of the additional train personnel and stock, but also the increased expense of signalling, &c. The long line to Sandown from Newport is devoid of passing loops, and these will be necessary if the district is to be developed.

On the Isle of Wight Railway, with the exception of Wroxall, it is possible for trains to pass at all stations, but Sandown is normally recognised as the best point for it to take place. However, if the boat is late, the fact of there being passing facilities at Brading saves one train from reflecting too adversely on the punctuality of the other.

Until traffic has developed sufficiently to justify double lines and more frequent trains this trouble is likely to remain, and the only palliative is to instil into the minds of the staff generally the necessity for saving minutes, and even half-minutes, whenever and wherever possible.

Another improvement that must certainly come with time is a direct approach to Newport station from the Freshwater line, instead of the very unsatisfactory passing of the station and then backing into it.

An increase in the number of through trains is also to be advocated, and it is suggested that those between Ryde and Freshwater should be restored, and that through Ventnor coaches should be attached to the Sandown trains, while if the Southern Railway intends to exploit services to Cowes by the Portsmouth route, through trains from Ryde to Cowes become a *sine qua non*.

It will assuredly be worth the reader's while to keep his eye on the Isle of Wight, and if he contemplates a holiday this little land has many attractions to offer, but the Isle of Wight as a holiday centre is outside the purview of the present article.

CHRISTMAS DAY IN NEW ZEALAND.

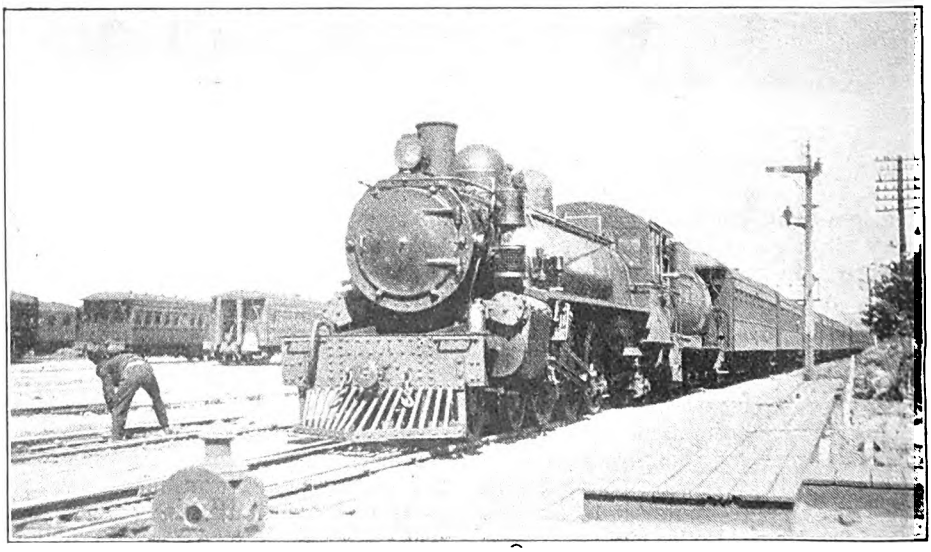

Photo.] [*W. W. Stewart.*

EXPRESS FROM WELLINGTON ARRIVING AT AUCKLAND.

4-6-2 Locomotive No. 666 (with new standard chimney).
Photograph taken on Christmas Day, 1923.

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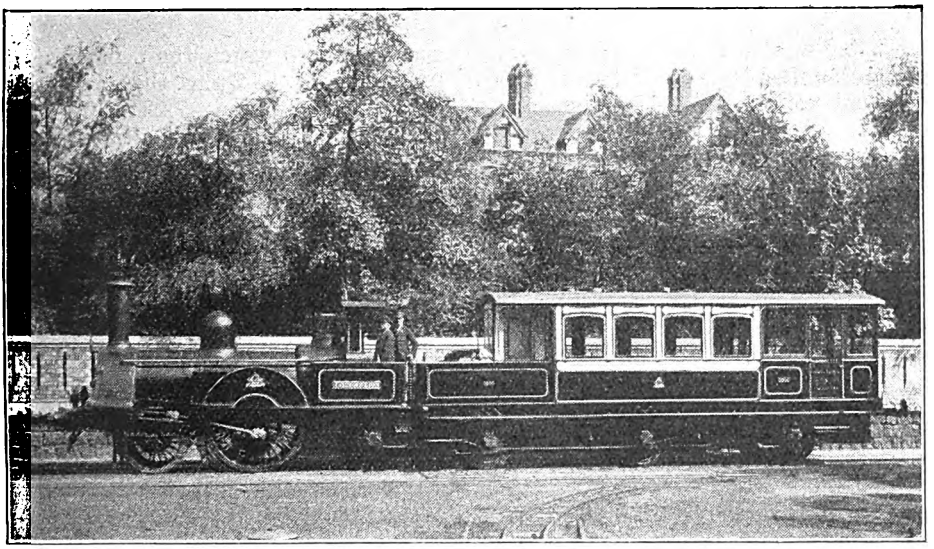

CHIEF MECHANICAL ENGINEER'S INSPECTION SALOON IN 1900.
Old single-driver engine "Locomotion." The "Cornwall" is now on this duty.

Recollections of Crewe, 1897-1902.

[No. I.]

By J. G. B. SAMS.

WHEN I went to Crewe in 1897 as an apprentice, Mr. F. W. Webb's long reign was drawing to its close, and several very interesting things were happening. The last lot of three-cylinder 2-2-2-2 compounds, the nine "John Hick" class with 6 ft. uncoupled driving wheels, commencing with 1512 *Henry Cort*, were being laid down. No. 184 *Problem*, a Ramsbottom 7 ft. 6 in. single (born 1859 or thereabouts) had just been fitted with the first pair of piston slide valves ever seen on the London and North Western Railway. The first four-cylinder compound, No. 1502, together with its exactly similar but four-cylinder simple sister, No. 1501, *Jubilee* and *Black Prince* respectively, had just been put into running, *Jubilee* being afterwards converted to a compound like its sister and becoming the prototype of a large class of these compounds. These two engines were the first to be built at the Steel Works end of Crewe Works (always known as the "New Works") and sounded the deathknell of new construction in the "Old Works," which is the portion of the Works one can see from the station. The "New Works" virtually commence about a mile along the Crewe and Chester branch, just before the train passes under a bridge labelled "Eagle Bridge" in large letters, so called as it is ornamented by some very fine cast-iron eagles that were retrieved from a parcel of scrap purchased for the foundry a good many years ago.

No. 184, together with No. 291 *Prince of Wales* of the same class, usually stood "up pilot" most of my time at Crewe. Nos. 1501 and 1502 used to take turns on the 3.8 and 3.23 p.m. (I am hazy about the exact minutes) up-Manchester and Liverpool–London and up-Scotsman respectively, returning the same evening with the 8.0 and 8.45 p.m. ex Euston back as far as Crewe, but shortly after my arrival they were stopped for repairs, after which they seemed to be employed in general service. No. 1532 *Hampden* was running

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about fitted with a double chimney and smokebox similar to Nos. 1501 and 1502. She looked perfectly horrible, having no rim to her chimney, but this was amended shortly afterwards.

The *John Hicks*, as they came out, were put to work on the Crewe–Carlisle section (for which they were designed), but they did not seem to be very satisfactory, as they very soon were to be seen on secondary trains in the Crewe area and even upon Crewe–Chester locals, on which service they took turns with Mr. Ramsbottom's "singles"! This was the last endeavour to use three-cylinder compounds on the Carlisle services, and 6 ft. 6 in. "Jumbos," piloted usually by a 6 ft. of the similar class, were to be seen on most trains until the four-cylinder compounds became numerous.

I commenced work (6 a.m.) in the Nut and Bolt Shop at the Steel Works, which was entirely devoted to the making of nuts, bolts, studs, and the like. The shop consisted of a forge at one end and a machine shop at the other. It was chiefly staffed by apprentices, and seemed to be the dump for most of the ancient small machinery of the whole Works.

In the evening time I, with others of my kidney, used frequently to go on to the station to watch the departure of the up-"corridor"—2 p.m. Glasgow and Edinburgh to London—7.28–7.32 p.m. at Crewe. This train was always taken on by No. 1304 *Jeanie Deans*, a 7-ft. three-cylinder 2-2-2-0 compound stationed at Camden (No. 1 shed), and driven alternately by Dave Button and Jesse Brown. This engine worked the corresponding down train, the 2 p.m. Euston to Glasgow and Edinburgh, on the same afternoon.

These two trains were usually made up to equal to 20½ vehicles, and were then, I believe, the only two trains running that were vestibuled throughout, although very soon after the 10 a.m. "Scotsman" in each direction was made up of vestibuled stock and diners, and the twenty-minute lunch interval at Preston station done away with. This 20 minutes was then knocked off the schedule, much to the excitement of a well-circulated London newspaper, which proclaimed "Another Railway Race to the North!" from the housetops.

The 7 ft. three-cylinder compounds of the above class, always known as the "Adriatics" from the name of the first one (No. 1301), were by far the most successful of the entire three-cylinder stud, and it was a great pity that more of

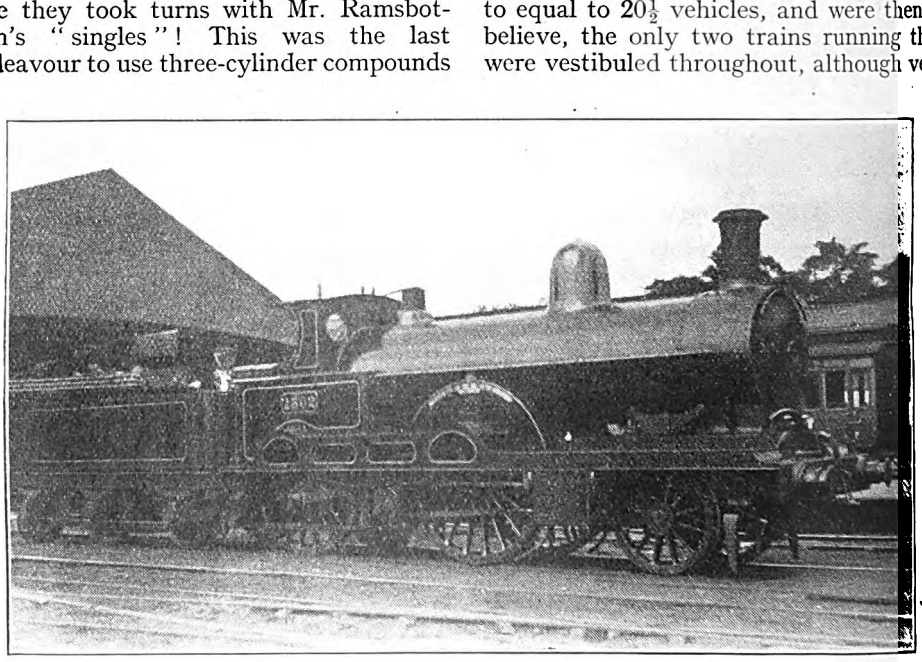

Photo.] [*H. L. Hopwood.*

THREE-CYLINDER COMPOUND 2-2-2-0 ENGINE, No. 1302 "OCEANIC."

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the same sort were not built, instead of the 7 ft. and 6 ft. 2-2-2-2 classes, which not only did not run so well, but gave a lot of trouble with the intermediate combustion chambers in their boilers.

After watching the frantic efforts of 1304 to get her train under way (it usually ended up in the carriage pilot saddle tank giving her a push-off!), the next thing was to cross over and watch the arrival at 8.40 p.m. of the 5.30 p.m. London-Liverpool and Manchester dining car express, the 2nd and 3rd class dining car on this train being merely an ordinary corridor coach (vestibuled to the 1st class *cum* kitchen car) fitted with tables and most uncomfortable. This train was always worked by the Edge Hill (No. 26 shed) 6 ft. 6 in. "Jumbo," which worked the 9.45 a.m. up ex-Lime Street on the same morning. It was generally piloted by a Crewe 7 ft. 6 in. single.

While I was in the bolt shop the second series of 0-8-0 three-cylinder compound coal engines, Nos. 1801 upwards, was commenced. It was said that the first lot, Nos. 2526 upwards, was ordered following upon the success in trial of the three-cylinder compound coal engine, No. 2525, over the two-cylinder simple but otherwise identical No. 2524, but then compounds were pre-ordained to be successful over simples in those days! A parallel case was that of Nos. 1501 and 1502.

No. 2524 was interesting in that cast-steel connecting rods of channel section were tried on her; I saw them both in the fitting shop some years after she was built and they had both cracked through to the Joy's motion-pin hole about one-third of the length along from the small end. They were evidently not considered advisable, as I never saw any others.

After three months spent in the bolt shop I was moved up to the fitting shop in the Old Works, which was a large machine as well as a fitting shop. The usual routine for us was to be put to work on drilling and shaping machines, then lathes, and next to the fitting benches. I had two years here, and when on a lathe was very pleased to have to skim up the piston valve rods of No. 1304 *Jeanie Deans*, which then happened to be in No. 4 erecting shop for general repairs.

The 7 ft. and 6 ft. 2-2-2-0 three-cylinder compounds were originally fitted with flat valves to their H.P. cylinders, but were afterwards converted to piston valves, and the H.P. cylinder diameter increased to 15 in. from 14 in. I saw a great number converted, but cannot say if the whole lot were so fitted.

The 6 ft. class had the hand-reversing gear to the L.P. valve gear removed, and a loose eccentric and gear substituted, but the 7 ft. class were built with this gear, which sometimes would produce very odd results. Given that the H.P. driving wheels slipped badly at starting after backing on a train, as the L.P. cylinder would naturally get a rush of steam before the L.P. driving wheels had rotated far enough to alter the loose eccentric from backward position to forward position, the L.P. wheels would slip *backwards* while the H.P. wheels were slipping *forwards*. The only cure was to open all cylinder draincocks and to try again!

About 1898 the first of the 18 in. cylinder 0-6-2 side tank engines with 5 ft. 2½ in. driving wheels appeared, these being the last class to be built in the Old Works. The Steel Works End had been building more and more, and now took over all construction; the shops there being larger and better equipped.

About this time, too, Mr. Webb's three 3-cylinder compound tank engines, two passenger and one goods, came in for scrapping, the first to go being No. 1977 (the so-called goods engine) which was a weird combination of four wheels coupled placed under the bunker and driven by the two H.P. cylinders, and a single pair of driving wheels driven by the amidships L.P. cylinder, a 2-2-4-0 arrangement. This engine spent its declining years at Crewe North shed (No. 15) working the Northwich branch, and was the one and only passenger tank engine in the North Shed.

This engine was followed into the boneyard by No. 1963, a 4 ft. 6 in. tank engine on the same lines as the standard 4 ft. 6 in. suburban tank engines, but with uncoupled drivers of the ordinary arrangement. Prior to its decease it had been stationed at Willesden (No. 2) shed and worked in a link with other 4 ft. 6 in. but simple tank engines on Mansion House-Broad Street and Willesden-Croydon services. I remember noticing

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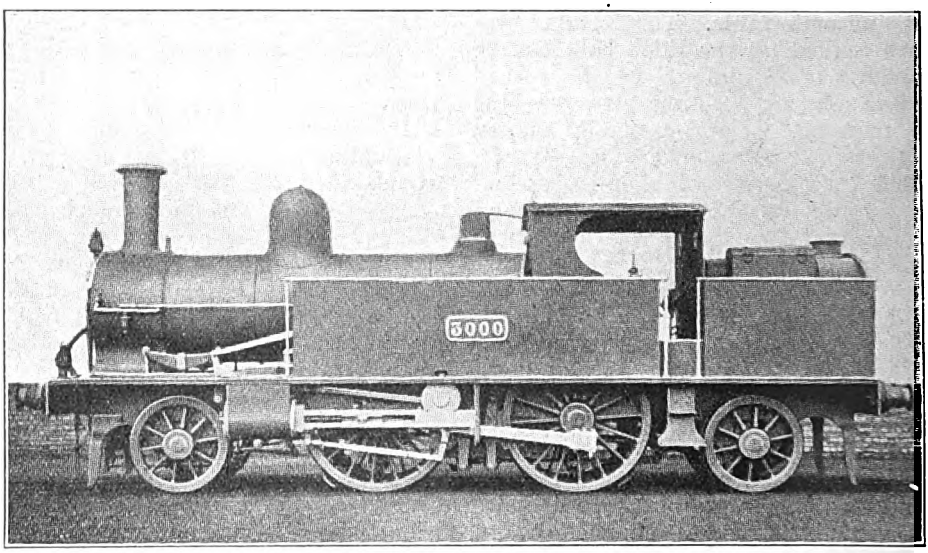
this engine, and the frightful fuss it made at starting (which seemed rather against success in suburban work), when at school in London. The engine appeared as a "patent engine for suburban work"; only two others, Nos. 66 *Experiment* and 300 *Compound*, both 6 ft. 6 in. 3-cylinder compound tender engines being labelled "patent," all the rest being marked "F. W. Webb's system."

Finally, No. 1967, a 5 ft. 6 in. standard tank engine, but a 3-cylinder compound with the uncoupled driving wheels arrangement, arrived for breaking up; her last years were spent on the Manchester-Buxton, &c., services, working from Longsight (No. 16) shed.



THREE-CYLINDER COMPOUND TANK ENGINE, No. 3000.

There were three of these engines, two of this type with uncoupled driving wheels (2-2-2-2), and one (2-2-4-0) with one pair uncoupled and the four rear wheels coupled.

After completion of my spell in the fitting shop, I was moved into No. 2 erecting shop, where I was lucky enough to be placed on the most interesting "pit" in the works (David Bates'), to which all the most ancient engines came for repair or breaking up.

I was "mate" to an old fitter named Beckwith, who had been a leading-hand erector at Wolverton in Mr. McConnell's days, being moved to Crewe on the amalgamation of the two Divisions. He had a vast scorn for Crewe-built engines, and was a mine of information of the doings of McConnell's "Bloomers" (a lot of which he had built himself), which he used to say had been broken up by Crewe out of sheer jealousy, as they were obviously (they were, too!) better than Trevithick's and Allan's tiny little 6 ft. and 6 ft. 6 in. "singles," which were their Northern Division contemporaries.

Among interesting engines that I have worked on was No. 3020 *Cornwall*, with its huge 8 ft. 6 in. driving wheels, originally built in 1847 with an underslung boiler, and employed in my time on Manchester-Liverpool expresses; generally light trains of about five coaches, but five minutes faster than to-day.

Also *Triplex*, a three-cylinder triple-expansion engine, and I believe the only triple-expansion railway locomotive ever constructed, that frequently had to be started with a pinch-bar, and which, when it *did* get going, ran itself out of steam very quickly indeed, owing to its small boiler and soft blast.

This weird machine merits a word or two. I forget the diameters of the cylinders, but I think that the H.P. (left-hand outside) was linered up to 9 in.; the M.P. (right-hand outside) retained the

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original diameter of 15 in. (*Triplex* had once been an ordinary Allan 6 ft. 6 in. single), and the inside L.P. was of 24 in. diameter. This particular cylinder was fitted with a loose eccentric valve motion, supposed to be reversed by the engine moving forward at the start before the steam arrived at the L.P. steam chest. This arrangement was similar to that fitted to the 6 ft. and 7 ft. 2-2-2-0 engines. The original valve motion was used for the H.P. and M.P. cylinders. The boiler was pressed to 200 lbs. per square inch, but owing to the last ring being part of the inwardly extended smokebox, the tubes were only about 6 ft. or 7 ft. long. The M.P. cylinder was fitted with a by-pass valve for admitting boiler steam direct, but it always seemed to me that the starting trouble was caused by the L.P. cylinder getting charged with steam before the engine had gone far enough to rotate the wheels and thus reverse the gear, in the manner common to self-reversing gears. The fact that the trouble only used to occur after hand reversing the rest of the engine, strengthened my opinion. Of course, the cylinder draincocks could be opened, but this would rather upset the H.P. cylinder owing to its smallness, so the best way was to get hold of a pinch bar and move her long—she was not very heavy. As soon as the axle stop had rotated far enough to work the L.P. eccentric and thus move the valve correctly, she would dart off with a violent surge, the sensation of which used to be well known to travellers on the London and North Western Railway behind the three-cylinder compounds. *Triplex* was supposed to be the stand-by engine for Mr. Webb's private coupé, but his driver (Harry Castlebar) once told me that he did not like to venture far behind her. It was too exciting, I expect!

I went once "round the Wrekin," *i.e.*, around the triangle formed by the Crewe–Whitchurch – Waverton Junction – Crewe lines, on her footplate on a trial trip after repairs and alterations, and I noticed the difficulty in maintaining the steam pressure, although we only had Mr. Webb's private combined coupé and tender (say 20 tons weight) behind us. The trouble in starting up after reversal was also noticeable, as I had to handle the pinch bar. Her usual abode was the paint shop at Crewe.

Other interesting engines worked on included *Engineer Crewe*, a 6 ft. Trevithick "single," fitted with the original type of boiler, and an enormous cab covering firebox and footplate, much larger than the engine proper. At one time there was a talk of putting her in the Museum at Crewe, but other orders came through and we broke her up, putting her plates (*Engineer Crewe*) on a 6 ft. four-coupled "A 11." The date stamped on her regulator was 1854, but tradition had it that she was the oldest engine on the line, which would put her back to 1847, before *Cornwall* was built.

Then we had *Engineer Stafford*, an Allan, 6 ft. 6 in. "single," fitted with the same sized boiler as the "A 11's" (more of this class anon), which, together with a short chimney and standard cab and panels, made her look very graceful and well proportioned. This one we mended up and sent back to work again.

But our pet particular friend was Mr. Webb's private engine, No. 3082, *Locomotion*, a 6 ft. Trevithick "single," fitted with an odd pattern of narrow-waisted cab and an original pattern boiler, with an enormous dome on the firebox. When withdrawn, I was told that *Locomotion* had been replaced by 3020 *Cornwall*. The former engine was, for some odd reason that I never discovered, chosen to represent the London and North Western Railway at the Stephenson Centenary.

I spent a lot of time repairing the last of the "Old Crewe Goods" engines. I believe its number was 3027. This engine finished up its days on the mysterious mineral lines in the Peak District beyond Parsley Hay, and was originally a tender engine; she had been converted to a tank engine, apparently by the simple method of putting the tank of the tender round the firebox, cutting each leg of the tank in half to make a space for the enginemen to get on or off the footplate, and putting in the necessary connecting pipes under the footplate. She had a narrow cab fitted with "eyebrows" over the windows, and if it was necessary to use the cylinder draincocks, both the driver and the fireman would have to

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alight and run alongside, there being no connecting gear from the cylinder cock handles to the footplate! After repair she went back to her Peak District, but before she went I had a pleasant day's outing on her footplate to Whitmore, to fetch sand for the Foundry.

I also had a lot of work at various times on several of the 2-4-0 "A 11" class. These were the original 6 ft. express engines, built in the 'sixties by Mr. Ramsbottom, the first one being No. 633 *Samson*. About a dozen of the ninety built were not broken up with their sisters, but were put on one side ready to replace the old "singles," then employed on permanent way and other officers' saloons, when their doom was pronounced.

The nameplates on the ninety 6 ft. "Jumbos," built in the 'nineties by Mr. Webb, would lead one to believe that they were rebuilds of Mr. Ramsbottom's engines of the "A 11" class, but this was not so, as only the wheels, splashers and cabs were utilised; but in the case of the odd dozen saved as mentioned, the replacing engines were new throughout, save for the nameplates. This was also true of Mr. Ramsbottom's 6 ft. 6 in. 2-4-0 engines, originally introduced to combat the weather on the Chester to Holyhead Section, the wind proving rather too much for the 7 ft. 6 in. "singles." The "rebuilt" on the nameplates of Mr. Webb's "Precedent" class is again really a misnomer, as only wheels and cabs and splashers were utilised, the latter complete with nameplates.

The two "Jumbo" classes were then the mainstay of the first-rate express services, all the regular longest hauls falling to them; thus the three daily Liverpool–London and return trains (8.0, 9.45 and 11.5 a.m. from Lime Street returning with the 4.15, 5.30 and 5.35 p.m. trains from Euston), also the 8.30 a.m. Manchester to London and 4.0 p.m. return were always worked by the 6 ft. 6 in. class, as well as practically all the chief trains between Crewe and Carlisle and the Wolverhampton share of the London and Wolverhampton Service.

The 6 ft. class were used between Birmingham, Crewe and Manchester, Leeds and Liverpool, and on several isolated services about the system. A number were stationed at Crewe and used as pilots on the Scotch express trains.

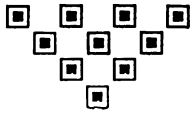
The rebuilt or "Special D X" 0-6-0 goods engines, originally of Mr. Ramsbottom's design, were the mainstay of secondary expresses in the Northern Area and long-distance excursions. Numbers of them were in use along the North Wales section, on the Seasonal Express Service, which seemed to be largely worked by Llandudno Junction and Ordsall Lane engines (Sheds Nos. 38 and 36).

Last Eastertide I noticed several of the new "Claughtons" (two being stationed at Llandudno Junction shed for the Manchester and Liverpool expresses) on trains formerly dedicated to these old goods engines—they are both six-coupled engines, but there seemed a difference in size!

The last express to the North, 8.15 p.m. from Crewe to Kendal, was always run by a Crewe "Special D X." Their specialty was the fact that they were fitted with the vacuum brake for passenger work, and had a slightly enlarged boiler, and the engines were then painted in the passenger style. The original "black" D X's, of which a few were never specialised, were fitted only with an inferior hand brake, and were all broken up while I was at Crewe, I think; there may have been one or two left after 1902, but I doubt it.

I believe that out of a class of 700 of these D X's, about 625 were rebuilt of which only one had an air pump for maintaining the train vacuum when running, all others having a small ejector for this purpose.

(To be continued.)



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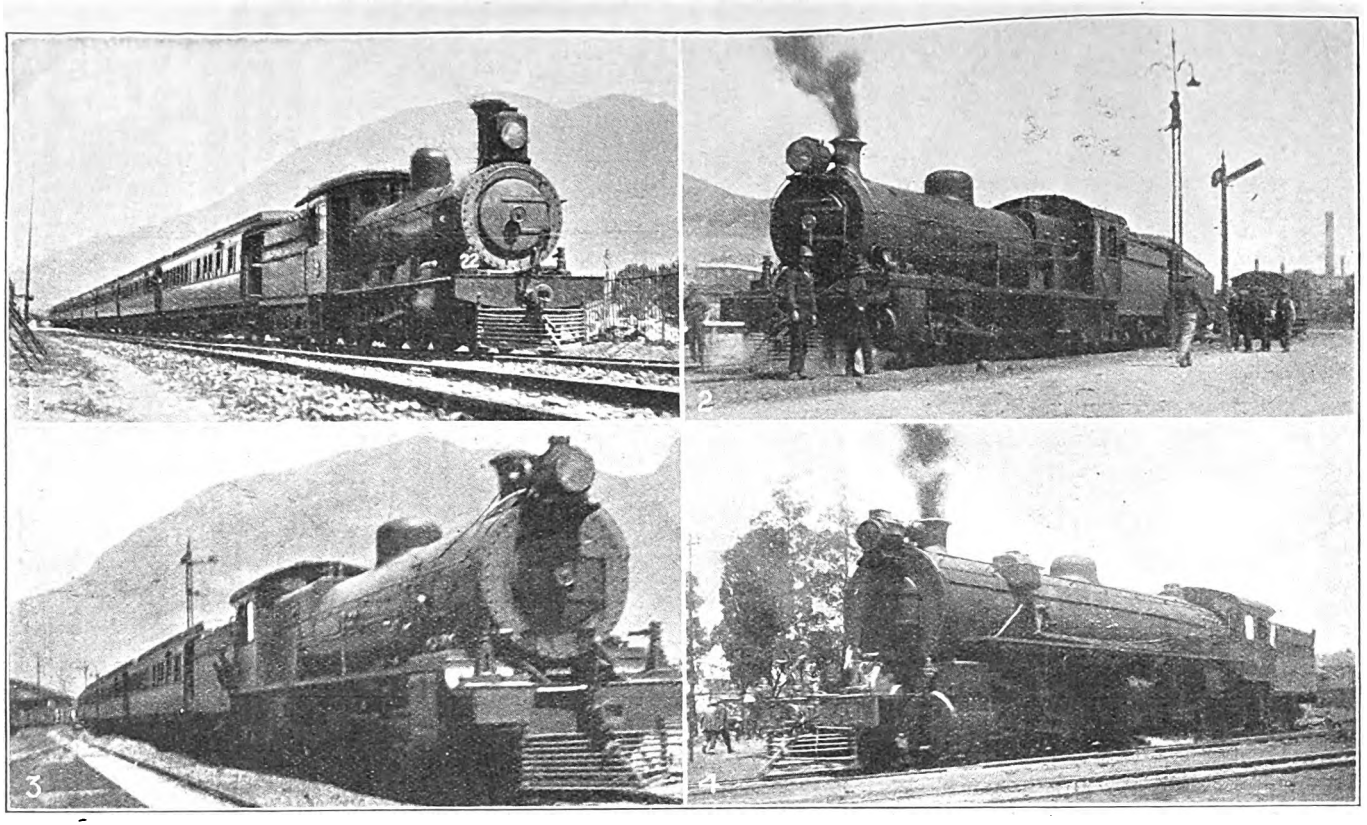
SCENES ON SOUTH AFRICAN RAILWAYS.



WE are indebted to Mr. G. Campbell Dickson, of Cape Town (Nos. 1 and 2), and Mr. C. G. Campbell Dickson (Nos. 3 and 4), of Pietermaritzburg, for the views reproduced above. No. 1 shows the new "Union Limited" express between Cape Town and the Docks (worked by an older locomotive), and Nos. 2 and 3 the same train at Monument station, Cape Town, with a main line engine attached. No. 4 illustrates one of the big Mallet engines of Class "M H," at Ladysmith. The first "Union Limited" express left Cape Town for Johannesburg on November 26, 1923. The "Cape Natal" express formed part of the "Union Express" as far as Kimberley.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN,
A.M.Inst.T., A.I.Loco.E.

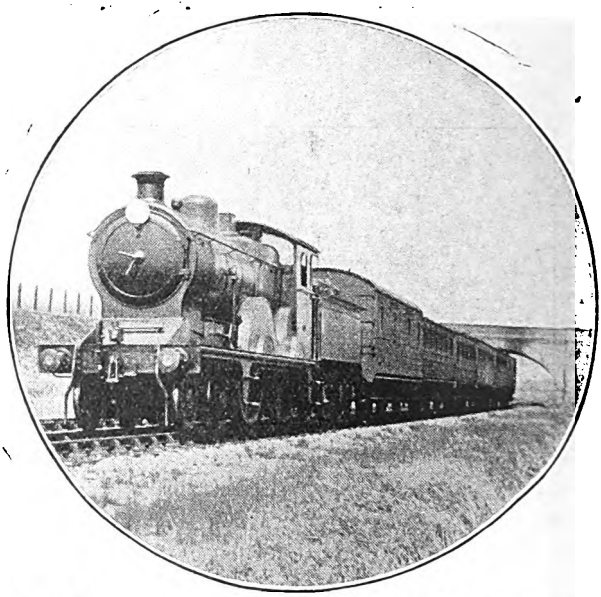

Photo.] [*C. J. L. Romanes.*

LONDON AND NORTH EASTERN RAILWAY.

Norwich to Ipswich "slow" near Diss.
Great Eastern 4-4-0 Engine, No. 739.

IN last month's issue the "Practice" division of this article was occupied with a discussion as to possibilities in future British locomotive design to meet the situation created by the fact that such engines as the Gresley and Raven "Pacifics" have reached the utmost limit of development permitted to the British express locomotive on traditional lines of design. Two tentative express locomotives planned by correspondents were discussed in detail. One, a 2-6-2—0-4-4 locomotive, in which the 0-4-4 portion represented a tender equipped with a two-cylinder driving mechanism, and which was intended to be driven with the tender leading, was designed chiefly to overcome any difficulties in regard to adhesion which may be occasioned by the fact that the maximum adhesion of any ordinary six-coupled express engine in this country is limited to 60 tons at most.

In the other the Garratt principle was utilised of slinging a large diameter boiler on a girder frame between two driving units, each in this case of the 4-2-2 type, constituting together a 4-2-2—2-2-4 type locomotive. In addition the trailing pair of wheels in each unit was equipped with "booster" gear, the idea being to provide a very high tractive effort on starting, and then, at speed, to cut the boosters out, and to utilise the advantage of two pairs of independent single driving wheels at high speeds, when this arrangement would in all probability tend to provide a higher drawbar pull than any coupled arrangement of wheels. The idea underlying these two designs was therefore directed towards increased tractive power in both cases, the first providing for the increased adhesion which might allow of the development of a higher effort than at present, and the second seeking directly to furnish increased tractive effort at all speeds from the lowest to the highest.

Increased efficiency of working, and more especially thermal efficiency, is a matter which must be approached along other avenues. It is, I suppose, a fact tolerably well known, that the overall thermal efficiency of the most efficient modern steam locomotive does not in the best conditions exceed about 7 per cent. That is to say, not more than 7 per cent. of the units of heat developed by the consumption of coal on the fire-grate are actually translated into useful work. The essential features of steam locomotive design lie at the basis of so low a figure. In the first place, as the locomotive boiler

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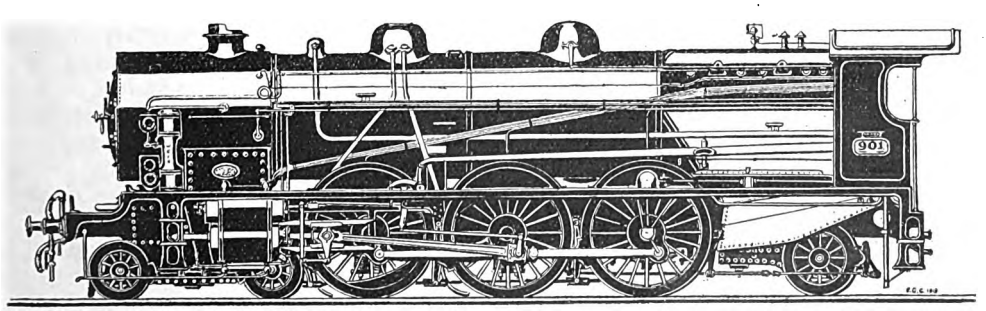
is required to produce steam more rapidly than practically all other types of steam boiler, very powerful continuous draught is required. For the production of this draught we rely on the suction created by the escape of partially expanded steam from the cylinders, spreading out with some violence from a blast orifice (which has been narrowed for this express purpose) into the chimney. In order to produce draught, therefore, we are throwing away out of the chimney a considerable proportion of the energy we have created in the conversion of the water to steam.

The object of turbo-condensing designs of locomotive, of which we have heard so much in recent years, is to make much more extended use of the propulsive properties of the steam in turbines than is possible in the single expansion of the locomotive cylinder; and after that to trap the remainder of the heat in the steam by condensing the latter after use and so to heat up the feed-water, as well as utilising in the turbines the partial vacuum created by the condensation. For draught, in the latter case, provision has to be made by means of power-driven rotary fans of large dimensions. The trouble in an engine of this type is to compress the necessary equipment within the rigidly restricted construction gauges of British railways, and within the maximum limits of weight permitted by their track. Again, in the design of the locomotive on traditional lines, for adequately rapid steaming, such extensive provision has to be made for utilising in innumerable boiler-tubes the heat developed in the firebox, that the ample passage thus provided for the heat through to the smokebox results in much of the heat itself also escaping through the chimney unused. The more an engine is "thrashed" by the abnormal production of steam, which means evaporation of water at above the normal rate, and is produced by over-consumption of coal, the greater is the drop in the thermal efficiency of the machine as a whole.

Two outstanding improvements of traditional locomotive design aimed at increasing thermal efficiency have been superheating and compounding. The former has now come into practically universal use, but not the latter. Compound working is designed to carry the steam through a further stage of expansion before it is finally thrown out of the chimney in its expanded condition. It is therefore directly aimed at an increase in thermal efficiency. But there are other valuable advantages attendant on compound propulsion. In the first place, as the high-pressure cylinders are normally of smaller diameter than two corresponding cylinders in a two-cylinder simple engine, it is possible to work a compound engine at a wide regulator opening (as well as at a long cut-off in the high-pressure cylinders), which prevents throttling of the steam.

By a right relation between high and low pressure cylinder volumes, and the provision of independent cut-off for both sets of cylinders, it is possible to utilise the steam to the best advantage, from the efficiency point of view, under all conditions of load and speed, but it is an undoubted fact that the compound engine gives the best results when being worked under the hardest conditions. Such conditions are difficult to secure in this country, where engines are in general treated with considerably more tenderness and consideration than is the case elsewhere.



SUGGESTED FOUR-CYLINDER 4-6-2 COMPOUND EXPRESS LOCOMOTIVE.

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Further, suitable change-valve arrangements are generally provided to enable a compound engine to receive high-pressure assistance in the low-pressure cylinders on starting—on the Midland 4-4-0 compounds, for example, the two large low-pressure cylinders are used as high-pressure cylinders until the engines get into speed—and a suitably designed compound has thus a substantial advantage over a simple in regard to starting effort, in addition to the advantages in regard to power output in extreme conditions.

Against compounding we have usually urged:—

(*a*) The claim that it has never come into general use in this country. But that, unfortunately, has been due to the radical defects of most of the systems tried, and not to the unsoundness of the principle. The fact that the Midland Division of the London Midland and Scottish Railway, after exhaustive tests, is adding twenty further to the existing "stud" of 4-4-0 compound engines is proof of at least one successful compounding system in use in this country. I would only add in this case that the engines concerned deserve better opportunities than they receive at present for displaying their tractive powers and thus of attaining the maximum efficiency attendant on compound working. It is tolerably certain that the superheated compounds could handle at least 300 tare tons without difficulty on the fastest Midland "Special Limit" timings, instead of the present maximum allowance of 240 tons.

(*b*) The question of "increased complication." But this spectre of "complication" is one which becomes very spectral indeed in the days of such engines, for example, as the Great Northern "Pacifics," or, still more so, the North Eastern "Atlantics" and "Pacifics," with their three cylinders and sets of valve-gear.

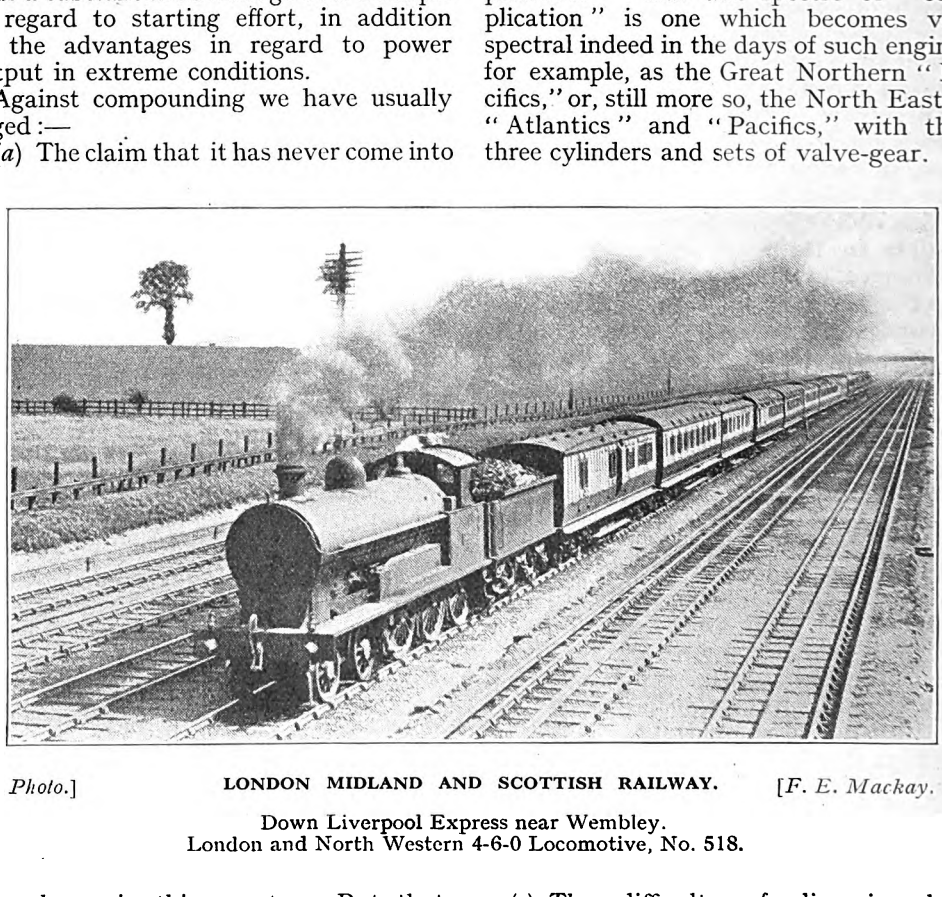

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*F. E. Mackay.*

Down Liverpool Express near Wembley.
London and North Western 4-6-0 Locomotive, No. 518.

(*c*) The difficulty of disposing low-pressure cylinders sufficiently large in volume to utilise the expanded steam from the high-pressure cylinders of a locomotive built on maximum British lines—comparable in tractive power, say, to an engine of Great Northern "Pacific" dimensions. The largest low-pressure cylinders which can be accommodated outside the frames, within the limited confines of the British loading gauge, are not more than 22 in. diameter, and a right volumetric relation between these and the high pressure is inclined somewhat to cramp

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the latter, when a boiler of the steam-producing capacity of, say, a Great Northern 4-6-2 is employed. Taking the Midland proportions between the piston area of high and low-pressure cylinders as a basis, 22 in. low-pressure cylinders, in a four-cylinder engine, would be " balanced " by high-pressure cylinders of only 14 in. diameter, or a single high-pressure cylinder of 20 in. diameter. This low-pressure cylinder difficulty is therefore a very material one.

Some years ago I received from a correspondent an interesting design for a British 4-6-2 compound express locomotive, accompanied by the carefully executed sketch reproduced on page 280; this will furnish a fitting sequel to the suggested types of engine with which I dealt last month. Concerning the engine in question my correspondent, Mr. F. G. Glover, wrote thus: " The compound system is like that employed on the North Eastern 4-4-2 compounds, Nos. 730 and 731, with high-pressure cylinders inside and low-pressure cylinders outside the frames, in that two sets of valve-gear only are employed to operate the four piston-valves; but it differs from the North Eastern arrangement in that it is possible both to exhaust steam from the high-pressure cylinders direct to the atmosphere, and also, conversely, to supply high-pressure steam directly to all four cylinders when maximum tractive power is required, so that the high-pressure pistons are not merely ' floating,' as is the case with the Smith system, when a Smith compound is starting. The firebox is of special design, being spread for two-thirds of its length across the frames, while the front portion is deeper and recessed between the frames. The ashpan is divided into three compartments, one serving the front portion of the firebox just mentioned, and the other two serving the wide rear portion. The front tube-plate is recessed 1 ft. into the boiler barrel, and the back tube-plate is 1 ft. 6 in. in advance of the firebox front. Special equipment includes a reducing-valve controlling the admission of steam to the four cylinders in the manner already described, and enabling the engine to work full compound, semi-compound or simple, the pressure in the low-pressure steam chest being always under the control of the driver; two sets of valve-gear only, Robinson superheater, a Weir feed-pump and heater delivering water to the right-hand side of the top-feed, in addition to the ordinary injectors; and, of course, mechanical lubrication, controlled from the cab."

Principal dimensions of the engine were given, as follows:—

Cylinders, H.P. (inside)	..	15 in. × 25 in.
,, L.P. (inside)	..	23 in. × 26 in.
Diameter of bogie wheels	..	2 ft. 10 in.
,, coupled wheels	..	6 ft. 6 in.
,, trailing wheels	..	3 ft. 6 in.
Bogie wheelbase	.. ..	7 ft. 6 in.
Coupled wheelbase	.. ..	13 ft. 8 in.
Total wheelbase of engine	..	34 ft. 3 in.
Height of boiler C.L. from rail		9 ft. 0 in.
,, top of chimney from rail	.. ..	13 ft. 5½ in
Length of smokebox	.. ..	7 ft. 6 in.
,, boiler barrel	..	19 ft. 0 in.
,, firebox (on centre line)	.. ..	9 ft. 3 in.
Diameter of boiler (maximum)		5 ft. 6 in.
Length between tube-plates	..	16 ft. 6 in.
Heating surface—		
Tubes	2,200 sq. ft.	
Firebox ..	190 sq. ft.	
Superheater ..	350 sq. ft.	
Total ..	————	2,740 sq. ft.
Firegrate area	.. .. ..	45 sq. ft.
Working pressure	.. ..	195 lb. per sq. in.
Weight in working order—		
On bogie wheels	22½ tons	
On coupled wheels	53¼ ,,	
On trailing wheels	18 ,,	
Total weight in working order	.. .. ..	93¾ tons

The only criticism that I would venture to direct at the design is, first, that the disposing of 23-in. outside cylinders at the level shown in my correspondent's sketch—or, for that matter, inclined at any higher level—would be difficult, if not impossible, within the confines of the British loading gauge. Again, the maximum benefits derivable from compound working seem to me to depend on a higher working pressure than 195 lb. per square inch, and in my judgment provision should be made for not less than 225 lb. Further, I should like to see a greater proportion out of the total engine weight than 53¼ out of a total of 93¾ tons engine weight available for adhesion purposes. In this connection I might explain that my correspondent had in mind chiefly the South Eastern and Chatham section of the Southern Railway (more particularly when the Channel Tunnel has been completed and opened) when preparing the design, and this will account for the comparatively

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modest extent of the adhesion weight. But in my view the 2-6-4 or 4-6-4 tank type is one better suited to future requirements on this section of the Southern group, from the standpoint of economical haulage, seeing that none of the through journeys are over 80 miles in length. I must, however, hasten on from any further consideration of this alluring subject, in order to devote adequate space to performance.

After such an introduction, we could not do better than to consider some present-day work of the Midland superheated compounds. They only figured to a small extent in my tables of running between Leicester and Manchester last month, this being largely due to the fact that, until the advent of No. 1045 of the new series, not one engine of this type has ever been stationed at Derby. I am given to understand that the turntable at Derby shed is not sufficiently long to accommodate the compounds with their ordinary tenders, but the difficulty has been got over in the first engines of the new series by providing them with the slightly shorter tenders of the "Princess of Wales" series of 4-2-2 engines; it will be remembered that the latter, on their construction in 1900, received double bogie tenders, but that high-sided six-wheeled tenders were substituted at a later date.

Curiously enough, after correcting the proofs of my last article, I had a particularly good run behind a compound on the 1.0 p.m. from Derby to Manchester, which is now hauled by a Trafford Park engine. The load was one of 8 bogies, weighing 217 tons empty and 230 tons full—well above those of the runs in the table—and the engine was No. 1021, non-superheated, driven by Leigh. We had a perfectly clear road throughout, save for a severe p.w.r. check at Ambergate, and passed Duffield in 8 min. 20 sec., Ambergate in 14½ min., Matlock in 23¾ min., Rowsley in 28½ min., Bakewell in 33 min. 40 sec., Miller's Dale in 43 min. 50 sec., and Peak Forest in 52 min. 25 sec., minima being 38 m.p.h. before Bakewell, 34 before Miller's Dale and 33 at the summit. Then followed quite a fast descent, Chinley being passed in 58¾ min., Cheadle Heath in 69 min. 55 sec. (after a maximum of 72½ m.p.h.); Chorlton was thus cleared in 74 min. 35 sec., and we stopped in Central in 80 min. 10 sec., all but 5 min. early. Net time was 79 min., instead of the 85 min. allowed, with a load nearly up to the rated maximum.

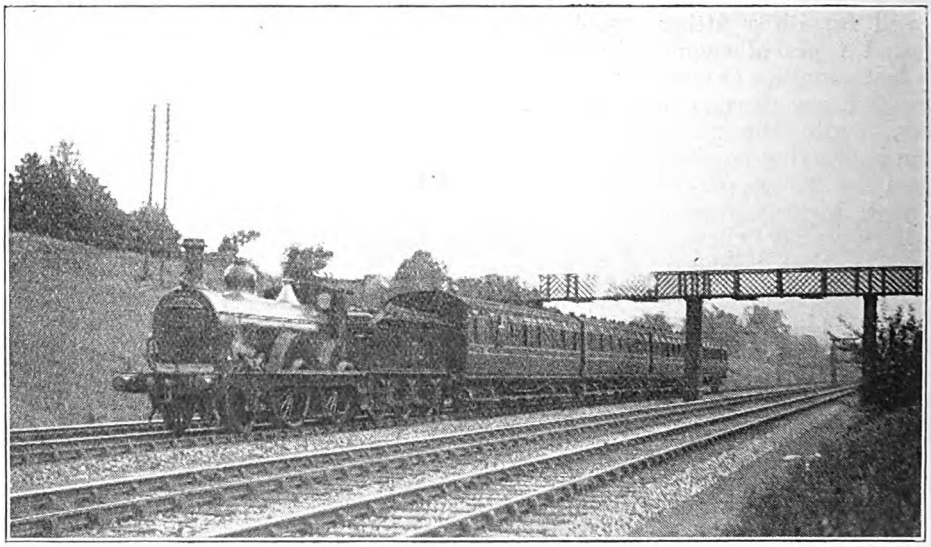

Photo.] LONDON MIDLAND AND SCOTTISH RAILWAY. [*H. Gordon Tidey.*

Down Bedford train. Midland 2-4-0 Locomotive, No. 170.

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And now for those runs on the Euston-Birmingham service which I promised last month. I have set these out in tabular form in rather more detail than I am accustomed to do, so that all the times and speeds may be readily followed. The table consists, first, of two up runs on the 4.50 p.m. from Birmingham to Euston, in both cases behind the Midland superheated compound No. 1033, one timed by a correspondent and the other by myself; and then, on the right-hand side, of two runs of my own on the complementary 9.10 a.m. down, behind a "George" and a superheated "Precursor" respectively; the two trains both include Willesden stops within their 2-hour schedules, and are booked to make the 107·5-mile Willesden-Birmingham run in 109 min. The loads, however, are but moderate, and, except perhaps at week ends, rarely exceed 200 to 220 tons all found. In such circumstances No. 1033 was anything but hard put to it to maintain time. My correspondent fared even better than I did, but I am inclined to think that the speeds noted by him are distinctly on the low side. This appears to be a repurcussion on his part from a previous habit of *over*-estimation, to which I have had occasion to draw attention on more than one occasion, and stresses yet once again, I fear, the impossibility of taking really accurate maximum and minimum speed records with the second hand of an ordinary watch.

Talking about speed records, by the way, may I at this point be permitted to make a slight digression? I was travelling the other day with a gentleman who is engaged in railway service of an itinerating character, and the conversation veered round to railway speeds, in which he appeared to display some interest. "The highest speed that I have ever timed was eighty-seven miles an hour," said my co-traveller. "Really," I remarked, "and where was that?" "Well, so far as I remember," he replied, "it was on the North Western, somewhere near Bletchley." "Near Bletchley," I said, "that is a distinctly unusual speed for anywhere near Bletchley. May I ask how you arrived at it?" "Oh, yes—it was taken over quite a long distance, and so was an average speed, you know. I got it by taking the times between the miles given on those Carter's Little Liver Pills boards!" At this stage the writer of "British Locomotive Practice and Performance" felt a fit subject to figure in one of those series of cartoons that are a

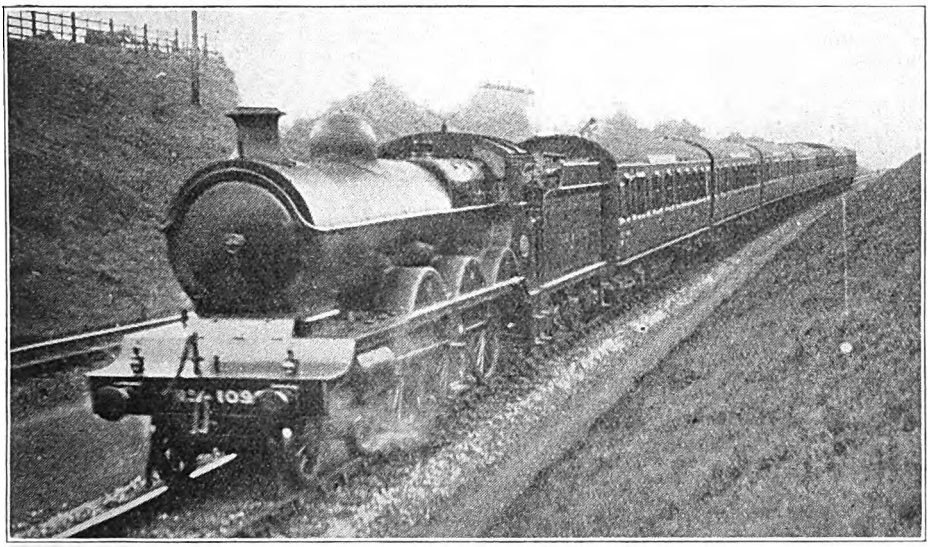

Photo.] LONDON AND NORTH EASTERN RAILWAY. *[Henry L. Salmon.*

Up Manchester–Marylebone Express.
Great Central 4-6-0 Locomotive, No. 1098.

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daily feature of many of our newspapers, and in the last of which the hero is generally depicted as dizzily viewing constellations of question, exclamation and other marks. *O tempora! O mores!*

But let us return to our records, with one minute out of the two minutes difference was attributable to the fact that the driver on the second run eased right down to 60 m.p.h. in passing through Coventry—after which the gain became more marked, finally reaching as much as 5 minutes at

L.M.S. (WESTERN DIVISION), EUSTON–BIRMINGHAM.

1033 M. 30 209 220		1033 M. 26 189 200		Engine, 4-4-0 No. Load (axles). ,, (tons tare). ,, (tons full).			1218 G. 26 185 195		7 T. 26 180 190	
Times.	Speeds	Times.	Speeds	Distance.	Stations.	Distance.	Times.	Speeds	Times.	Speeds
m. s.	m.p.h.	m. s.	m.p.h.	miles.		miles.	m. s.	m.p.h.	m. s.	m.p.h.
104 30	—	109 35	—	107·5	Willesden ..	0·0	0 00	—	0 00	—
100 46	52	105 40	—	104·8	Wembley ..	2·7	4 35	52	4 20	56½
97 25	62	102 00	—	101·5	Harrow ..	6·0	8 15	56½	7 50	60
95 35	56	99 55	—	99·6	Hatch End ..	7·9	10 15	57½	9 40	61
92 46	58½	96 10	42½	96·9	Bushey ..	10·6	13 05	—	12 15	—
91 18	60	94 25	55	95·4	Watford ..	12·1	14 30	65	13 35	70½
eased		eased								
88 08	70	91 05	70½	91·9	King's Langley	15·6	17 55	—	16 45	66
85 08	69	88 05	71½	88·4	Boxmoor ..	19·1	21 25	61	19 55	65
82 05	63	85 05	68	84·9	Berkhamsted	22·6	24 55	61	23 10	62½
78 20	52	81 25	54	81·2	Tring	26·3	28 35	61	26 50	61½
73 37	58	76 30	55½	76·8	Cheddington ..	30·7	32 30	72½	30 30	83½
69 42	62	72 25	60	72·7	Leighton ..	34·8	35 55	—	33·30	80½
63 38	64	65 55	64½	66·2	Bletchley ..	41·3	41 35	70½	38 25	79
58 30	69	60 25	—	60·5	Wolverton ..	47·0	46 40	71½	42 45	80½
56 30	75	58 20	75	58·1	Castlethorpe ..	49·4	48 50	—	44 40	75
									eased	
52 05	62	53 55	60	53·0	Roade	54·5	54 00	54	49 50	52½
49 25	64½	51 00	—	50·1	Blisworth ..	57·4	56·55	—	52 55	—
43 20	73	44 45	74	43·2	Weedon ..	64·3	63 05	70½	59 45	—
38 30	61	39 50	—	37·6	Welton ..	69·9	68 25	61½	65 25	—
									sigs.	5
29 35	*40	30 55	*35	30·3	Rugby ..	77·2	75 40	*30	75 00	—
28 40	*44	30 00	*45	29·7	Rugby No. 7..	77·8	77 00	—	76 10	—
23 05	76	24 15	70½	23·8	Brandon ..	83·7	83 05	66	82 10	66
19 08	75	19 35	60	18·9	Coventry ..	88·6	87 35	—	86 35	—
		eased								
16 10	—	16 30	72½	15·4	Tile Hill ..	92·1	91 25	55	90 20	56½
14 25	63½	14 40	61½	13·4	Berkswell ..	94·1	93 25	—	92 20	—
11 28	70	11 35	70½	10·1	Hampton ..	97·4	96 30	71½	95 20	74
8 25	70	8 25	66	6·5	Marston Green	101·0	99 40	—	98 20	—
5 57	60	5 50	61	3·8	Stechford ..	103·7	102 10	—	100 40	—
3 48	45	3 45	50½	1·9	Adderley Park	105·6	104 10	—	102 35	—
									p.w.r.	
0 00	—	0 00	—	0·0	New Street ..	107·5	107 30	—	107 00	—

M = Midland superheated three-cylinder compound. G = "George V" class, *Australia*. T = Superheated "Precursor" class, *Titan*. * Service speed restriction. Speeds shown above are maximum and minimum speeds, by chronograph in all runs but the first.

their tiresome insistence on fifths of a second, and mile-posts and other essential aids to accuracy. It will be seen that No. 1033 on her first trip gained gradually on the second trip all the way from Birmingham to Wolverton—to which point Willesden. On both runs the engine was well ahead of time at Watford, and was very severely eased there; on the second occasion the easing was such as to be positively farcical, speed dropping to 42½ m.p.h. at Bushey troughs, with the result

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that we lost 35 seconds on schedule to Willesden thereby. However, we reached Euston in an overall time of 10 seconds inside the two-hour schedule. Although a stop could not have been effected at Coventry on the first trip within the very fast 19-minute schedule, "even time" was attained a mile or so later, and after the Rugby slowing and the ascent to Kilsby, was re-attained by Weedon. Willesden could have been reached easily in 102 minutes, or very little over, but for the easy going from Tring onwards. It will be seen from the tabulated speeds that nothing very exceptional was done on either trip; my own highest rate was 75 m.p.h. at Castlethorpe. There was very little in the running to distinguish it from that of the North Western *George the Fifth* class 4-4-0's, but it would be distinctly interesting to have a comparison of the coal and water consumption, as between the two types. A Midland Class "2" engine, No. 557, has also been tried on this train, but had to be worked very hard to maintain time, and was withdrawn after a somewhat serious mishap.

We now come to the down runs, which incorporated some electrifying features, and particularly the second of them. On neither occasion had I any preliminary conversation with the driver; on the second run, indeed, I only boarded the train at Euston with a few seconds to spare, and had almost resigned myself to going by the 9.15 a.m. instead. The chief feature of the first run was that from 65 m.p.h. at Watford we never fell below 61 right up the 1 in 330 to Tring, and, further, that we surmounted the similar incline to Kilsby Tunnel at a minimum rate of 61½ m.p.h. "Even time" was attained between Bletchley and Wolverton, and we kept inside "even" thereafter until we stopped at Birmingham in precisely 107½ minutes for the 107½ miles from Willesden, and that after the most moderate running from Rugby onwards.

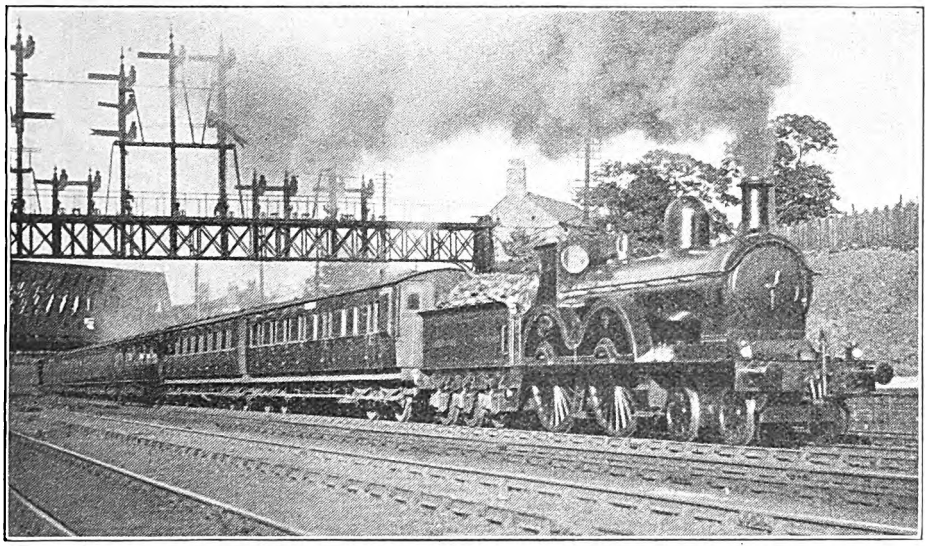

Photo.] YORK-MANCHESTER EXPRESS LEAVING YORK. [*Henry L. Salmon.*
Lancashire and Yorkshire 4-4-0 Locomotive, No. 1099.

This was good enough indeed, but the second journey was a veritable *tour de force*. The engine was one of the "Precursors" now superheated—the engine, in fact, which in pre-superheat days ran the experimental trials day and day about between Rugby and Brighton with the Brighton 4-4-2 tank No. 23. No. 23, however, would be hard put to it to touch a performance anything like this. First of all, up the 1 in 330 past Wembley, Harrow and Hatch End, we *accelerated* to 61 m.p.h., and then touched 70½ on the faint 2-mile fall to Watford. From there we went up

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the 1 in 330 to Tring in the record time of 13 min. 15 sec. for the 14·2 miles, not falling below 61½ m.p.h., so that we had all but attained "even time" on this almost exclusively rising length from Liver Pills" failed to stir us up to quite so amazing a maximum as 87 m.p.h., we certainly did reach 83·3, and from crossing the "eighty" line just below Tring, our speed hovered in its immediate neighbour-

L.M.S. (MIDLAND DIVISION) 9.0 A.M. ST. PANCRAS-NOTTINGHAM.

Distance.	Engine, 4-4-0 No. / Load (axles). / ,, (tons tare). / ,, (tons full).	Schedule.	1043 C4N 29 179 190		1040 C4S 29 183 195	
			Times.	Speeds.	Times.	Speeds.
Miles.		min.	min. sec.	m.p.h.	min. sec.	m.p.h.
0·0	St. Pancras	0	0 00	—	0 00	—
1·5	Kentish Town	4	4 10	—	3 45	—
5·1	Cricklewood	—	9 40	—	8 50	—
6·9	Hendon	10	11 50	—	10 45	65
12·4	Elstree	—	18 50	40	16 15	55
15·2	Radlett	—	22 00	64½	18 50	77½
19·9	St. Albans	25	27 05	46½	22 55	60
24·6	Harpenden	—	32 50	—	27 35	75
27·3	Chiltern Green	—	35 30	—	29 55	—
30·2	Luton	36	38 30	—	32 30	—
32·8	Leagrave	—	41 30	—	34 40	66
37·3	Harlington	—	45 20	79	38 55	60
41·8	Ampthill	—	48 55	72½	43 35	50
					sigs.	*30
49·8	Bedford	54	55 40	79	52 15	76½
53·0	Oakley	—	58 35	—	55 00	68
56·7	Sharnbrook	—	62 15	—	58 15	71½
59·8	M.P. 59¾	65	66 30	39½	61 50	47
62·7	Irchester	—	69 30	—	64 50	60
65·0	Wellingborough	70	71 30	74	67 10	*50
68·2	Finedon	—	74 30	60	70 40	67
72·0	Kettering	78	78 40	†51	74 35	—
			slack	*30	slack	*30
77·0	Geddington	—	85 50	—	81 45	—
79·5	Weldon	—	88 30	—	84 10	—
84·9	Harringworth	—	93 30	76½	89 30	—
90·1	Manton	99	98 25	—	94 50	—
93·8	Oakham	—	103 00	44½	98 45	55
99·2	Whissendine	—	108 55	—	103 45	—
					sigs.	*40
101·5	Saxby	—	111 05	70½	106 05	—
105·4	Melton	115	114 35	—	110 50	—
			slack	*47	slack	*35
109·2	Grimston	—	119 45	43½	116 40	—
112·6	Upper Broughton	—	123 45	—	120 25	—
120·7	Edwalton	—	131 20	75	128 00	—
					sigs.	
123·5	Nottingham	135	134 50	—	133 00	—

† Minimum before shutting off steam. * Slacks by brake. C = Compound. 4 = Class "4." N = Non-superheater. S = Superheater. Speeds in above table are maxima and minima by chronograph.

Willesden! But this was only a beginning. After Tring, Driver Brightland proceeded to break every record I have ever made or seen onwards to Bletchley and Wolverton. Although the stimulus of "Carter's Little hood, fluctuating chiefly between 77½ and 82, until we were past Wolverton. Over the 23·1 miles from Tring to Castlethorpe our average was 77·7 m.p.h.; over the 16·3 miles from Cheddington to Wolverton

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79·8; and from Cheddington to Leighton it was maintained at 82 m.p.h.

After Castlethorpe, as we were now much ahead of time, the engine was drastically eased down, and the only remaining feature of note was the 74 m.p.h. attained at Hampton. But if we allow for the two checks and the easing by merely taking the fairly fast times of the preceding run, our time of 107 minutes for the 107½ miles start-to-stop is whittled down to 102½ minutes, and with a continuance of the same effort there is no knowing what might have been our overall time. With a bad p.w.r. check at South Hampstead, in addition to the two later checks, and a stop of 45 seconds at Willesden, the throughout time from Euston to Birmingham was 117¾ minutes, equivalent to a net non-stop time of somewhere about 109 minutes for the 112·9 miles. There is little doubt that a *George the Fifth* 4-4-0 could do the Euston-Birmingham run, as a matter of habit, given a load not exceeding 200 tons, in the 1¾ hours talked of in past years without any great difficulty.

I received recently from a correspondent details of a run behind No. 127, *Snake*, of precisely the same type, with the following 9.15 a.m. train, which was almost a counterpart of mine as far as Roade. The train, which weighed 190 tons all found, was 10 min. late away from Willesden owing to fog. Harrow was passed in 8 min. 11 sec., Watford in 14 min. 2 sec., at about 70 m.p.h., Boxmoor in 21 min., and Tring in 28 min. 2 sec., speed having been sustained at 60 m.p.h. all the way up King's Langley. From Tring the times were only a shade over mine—10 sec. more to Cheddington, 3 sec. thence to Leighton, again with an average of over 80, 7 sec. more to Bletchley, 6 sec. more on to Wolverton, and 5 sec. *less* to Castlethorpe, making a total of 31 min. 52 sec. to Cheddington, 34 min. 55 sec. to Leighton, 39 min. 57 sec. to Bletchley, 44 min. 23 sec. to Wolverton, and 46 min. 13 sec. to Castlethorpe. Both the time of 11 min. 55 sec. from Tring to Bletchley on this run, and my own 11 min. 35 sec., are below my previous record of 12 min. exactly. Finally, Roade was passed on this run in 51 min. 43 sec., at a reduced speed of 30 m.p.h. for the cross-over, and Northampton, 60·5 miles, was reached in 60 min. 20 sec., start to stop, or 6¾ min. less than the time allowed. The driver on this fine journey was W. Dawes, of Bushbury shed. Did space permit, I might quote many further smart runs on the Euston–Birmingham service, submitted by various correspondents, but in any case they would serve to furnish something of an anti-climax to such extraordinary efforts as these.

And now, in conclusion, in reverting to the work of the Midland compounds, I want to present, in my second table, a couple of runs on the non-stop 9 a.m. 135-minute express from St. Pancras to Nottingham, one behind a non-superheated and the other behind a superheated compound, as affording a perfect foil to one another in the matter of locomotive performance. Both were timekeeping runs; but the difference in the relative work with the same load uphill and downhill is such as to be almost amusing. No. 1043 made a poor start, losing 2½ min. to Luton, but snatched nearly a minute on schedule in descending to Bedford, all but another from Wellingborough to Kettering, and 1¼ min. between Kettering and Manton, in virtue of the three high downhill maxima on these lengths of 79, 74 and 76½ m.p.h., let alone another 75 on the descent to Nottingham. On the first of these same descents No. 1040, by shutting off steam, was allowed to fall to 50 m.p.h.; on the second speed never rose above 60 and was eased to 50 through Wellingborough; and on the third 60 was about the maximum reached, as is evident from the times. Furthermore, No. 1040 was much more severely slacked than No. 1043 at Melton Junction, and experienced adverse signals at three different points on the journey.

The secret of No. 1040's tremendous advantage over No. 1043 lay in the former's astonishing uphill work. Up 5 miles at 1 in 161-176 from Hendon to Elstree we fell from 65 to 55 m.p.h.; up 4½ miles at almost exactly the same inclination from beyond Radlett to beyond St. Albans, from 77½ to an absolute minimum of 60 m.p.h.; up 2 miles at 1 in 180-214, and 3¾ further at 1 in 119 to Sharnbrook Summit, from 71½ to 47 m.p.h.; 3 miles of level beyond Wellingborough produced an acceleration from 50 to 67 m.p.h.; and, lastly, up 6 miles

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steepening from 1 in 167 to 1 in 143, from Harringworth to near Oakham, which includes ¾-mile down at 1 in 200 to Manton, we fell merely from a shade over 60 to a minimum of 55 m.p.h. on the 1 in 143 itself—perhaps the most outstanding feat of the journey. To cover the 27·7 miles from Cricklewood to Leagrave, of which the tendency is throughout against the engine, and at least 17 miles are on fairly steep adverse grades, in 25 min. 50 sec., was a really amazing feat, and I never remember previously passing Luton in as brief a time as 32½ min. from St. Pancras.

speaking of Knight's fine effort with 4-6-0 No. 748 on the 11 a.m. out of Waterloo, the time of 51 min. 30 sec. out to Basingstoke was not the fastest that I have recorded over this section, as I claimed. Reverting to an article of mine in 1916, he cites three runs, one on the same train with 4-cyl. 4-6-0 No. 458 and 370 tons, on which Basingstoke was passed in 51 min. 6 sec., another with rebuilt 4-2-2-0 No. 720 and 260 tons, on which the time was 51 min. 17 sec., and a third with No. 446 and 260 tons, when the time was 51 min. 27 sec.—all slightly less than

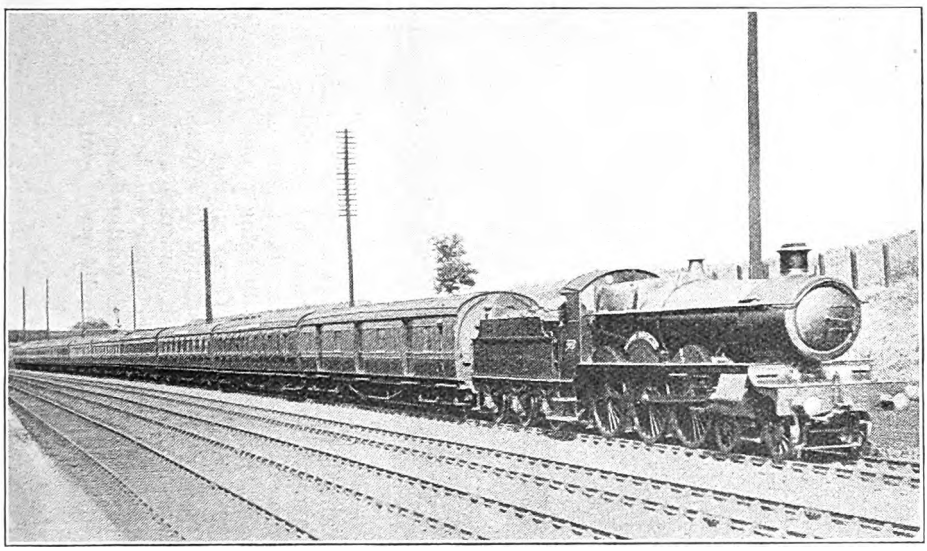

Photo.] GREAT WESTERN RAILWAY. *[F. E. Mackay.*

South Wales Restaurant Car Express. 4-6-0 Locomotive, No. 2926 "Saint Nicholas."

If we take the downhill times of No. 1043, which had been left behind by No. 1040 by nearly 7 min. when only 33 miles of the journey had been covered, we get a net time of 124¼ min. for the 123·5 miles, or 10¾ min. under schedule, and a journey in less than "even time," despite the extreme hardness of the road, would doubtless have been easily feasible. Such times serve to stress in no uncertain fashion the possibilities of the superheated Midland compounds.

I am indebted to two readers for communications bearing on my February contribution. One points out that, in the more recent time with No. 748. I had overlooked these previous records when writing. Another correspondent mentions that, as the 83½ mile-post out of Waterloo is on Salisbury Station, the distance should be given as 83·5 and not 83·8 miles. I was already aware of the fact that the mile-post distances and the working-book distances over the South Western main lines are by no means in exact agreement, but until a completely revised list of distances is published, or becomes otherwise available, I am compelled to continue the use of the distances set out in the working time-tables.

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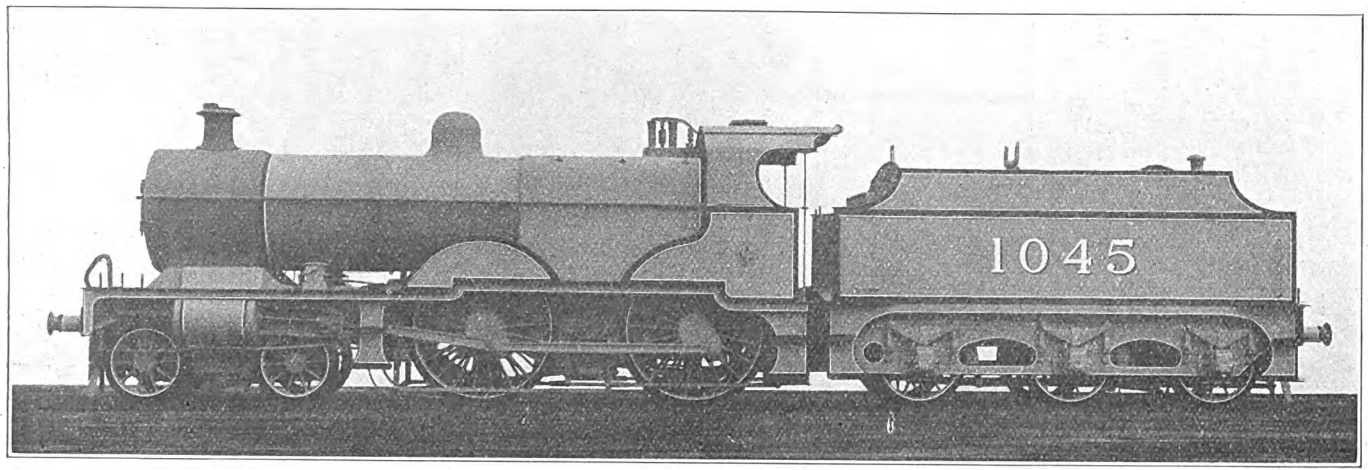
NEW THREE-CYLINDER COMPOUND LOCOMOTIVES, L.M.S.R.



REFERENCE was made recently to the fact that an order for 20 new 3-cylinder express compound locomotives was nearing completion at the Derby Works of the London Midland and Scottish Railway. The first of the new engines has now been placed in service, and by the courtesy of Mr. George Hughes, Chief Mechanical and Electrical Engineer, and Sir Henry Fowler, Deputy Chief Mechanical Engineer, Derby, we are enabled to reproduce a photograph of the locomotive.

These new locomotives differ from their predecessors in that they are fitted with smaller coupled wheels, 6 ft. 9 in. diam., and cylinders 19¾ and 21¾ in. diam., the result being a considerable increase in the tractive effort.

These engines have proved highly successful in the handling of express passenger trains between London (St. Pancras) and the North, and for some time past they have also been working on the Euston–Birmingham and Euston–Manchester traffic, with, we understand, equally good results.

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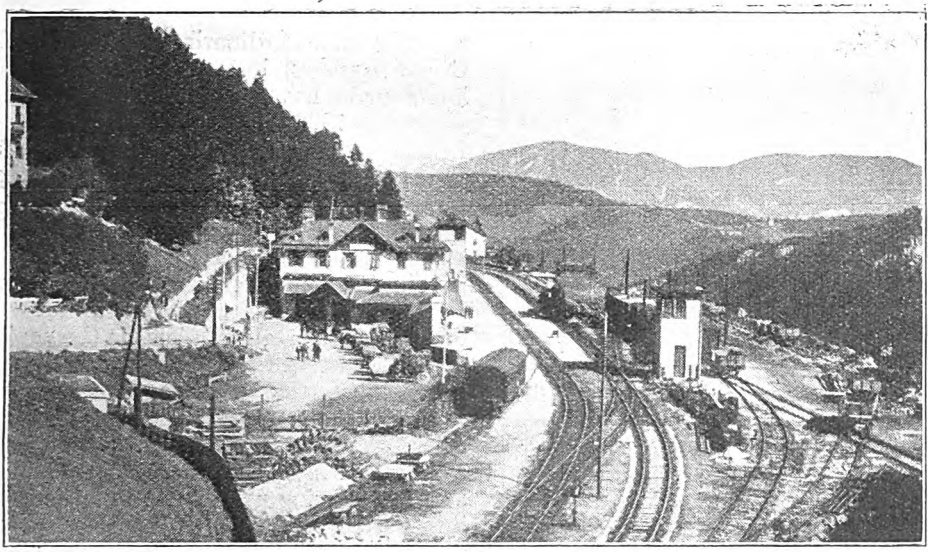

Photo.] [*E. J. Miller.*

SEMMERING STATION (FROM TUNNEL), AUSTRIAN SOUTHERN RAILWAY.

To Vienna via the Arlberg Railway.

By E. J. MILLER.

AS a result of the war the Arlberg route from England and France to Austria and places beyond has become of increasing importance. Between Paris and Vienna this route is second in importance to that via Karlsruhe and Munich, over which the Orient Express has run for many years, except during the war, when it was replaced by the famous "Balkan-Zug" from and to Strasbourg. The Orient Express continued by the same route from its post-war reintroduction to the French occupation of the Ruhr in January, 1923. Owing to the refusal of the Germans to haul this train, it was diverted via Belfort, Bâle, and the Arlberg, rejoining its original route at Salzburg. Thus we find, at the moment of writing, the Arlberg route is the only practical one between Western Europe and the countries reached via Vienna. In the RAILWAY MAGAZINE for March, 1909, an article "The Arlberg Railway in Winter" was published, but in this contribution it is only intended to describe the Arlberg as part of a through route.

The present train services compare but poorly with those of the pre-war time-tables. Now the Orient Express leaves Paris at 14.00 and reaches Vienna at 22.30 the next day. The daily express leaves at 20.55 and arrives at Vienna on the second morning at 6.50. A third service leaves Bregenz at 14.43 and follows the last-mentioned train from Feldkirch to Vienna about three hours later.

We will suppose the traveller to have left Paris by the night train and to have reached Buchs, the frontier station, at 11.18 the next morning, where the Swiss Customs examination takes place. Before starting it will be of interest to take a look at our train. There are three cars from Paris to Vienna (sleeper, first and second composite, and third class), one sleeper Ostend–Budapest, one first, second and third composite Bâle–Budapest, one luggage-van Bâle–Salzburg, two cars Zurich–Vienna (first and second composite, and third class), and a restaurant car Bâle–Saalfelden. The total weight of the train is 328 tons. Three days a week this train also carries a through sleeper Calais–Bucarest, and this car, together with the

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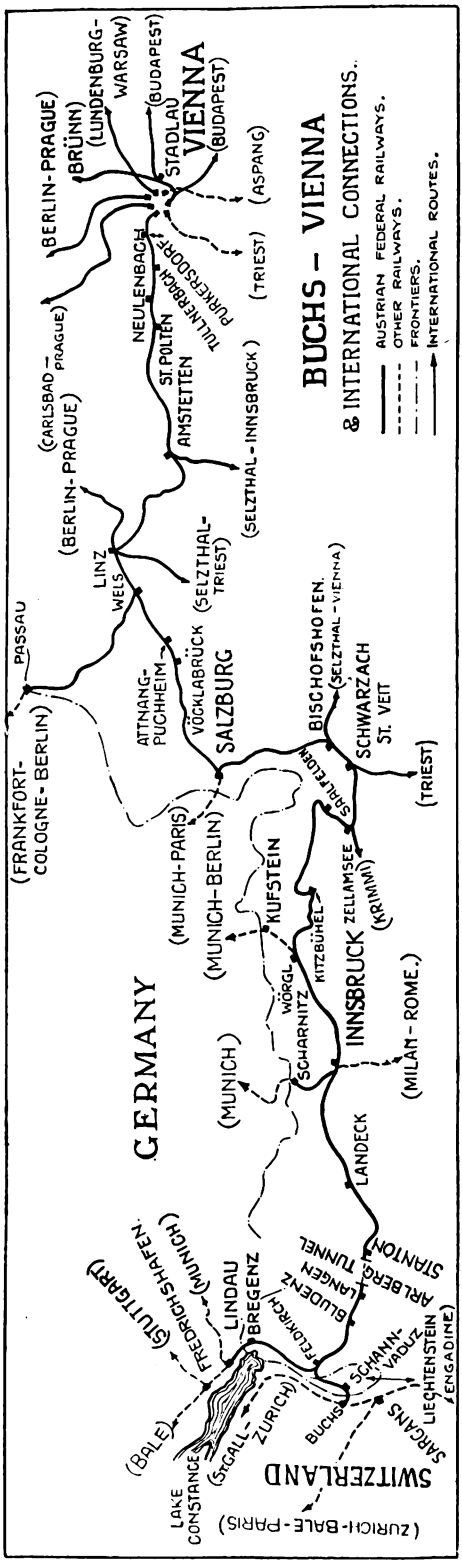

Ostend vehicle, ordinarily form part of the Orient Express, but as the times of the latter train have been re-arranged since January, 1923, in order to provide a London connection, these cars work as mentioned. In the reverse direction they form part of the train *de luxe*.

The train leaves Buchs at 12.3, hauled by an old 4-4-0 locomotive, with a lignite-burning chimney, crosses the Rhine and Swiss frontier, and stops in 6 minutes at Schann-Vaduz station. This is the capital of Lichtenstein, the smallest European principality, the railways of which are worked by the Austrian State. Leaving after a minute, we rise by gradients averaging 1 in 150, and arrive at Feldkirch at 12.27, having passed from Lichtenstein into Austria 5 miles before stopping. Here a stay of 33 minutes is made, during which time a passport and baggage examination is conducted by the Austrian authorities, and the locomotive is changed for a modern 2-10-0. At 13 o'clock the train proceeds to Bludenz, the up gradient being 1 in 100, arriving at 13.27. After a stop of 13 minutes, during which period we have a banking engine of the 2-8-0 type attached, we commence the heavy work of climbing the mountain grades to Langen. The 25½ kilometres consume 65 minutes, being at the rate of 14·6 m.p.h. The gradient throughout is 1 in 32, and the rise in feet 2,090. Considering the weight of the train, this is not really a bad performance. The journey from the scenic point of view is wonderful, the train being nearly all the time high above the valley, in some places over 400 ft. The engineering features are no less interesting. Langen is the western entrance to the Arlberg tunnel, which extends to St. Anton-in-Arlberg, 6 miles 587 yards, and is double track, the only section between Buchs and Innsbruck. The gradient ascends steeply to the culminating point just beyond half-way, a rise of 305 ft., the height at St. Anton being 4,270 ft. The banker is detached and Langen is left at 14.53. We reach St. Anton at 15.11, after traversing the tunnel, and leave again after a 3 minutes' stay. From St. Anton to Landeck the train descends the eastern ramp, on a continuous gradient of 1 in 38, falling 1,720 ft. in less than 18 miles, reaching Landeck at 15.48. The engineering features of this section are not so outstanding as those on

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the western side of the tunnel. Two notable structures may be sighted, the Trisanna Viaduct (840 ft. long and 280 ft. high) crossing the Paznaun Valley at its confluence with that of the Stanza, and the viaduct over the Inn, just before Landeck station, with nine brick arches and centre span of steel construction.

We leave Landeck at 15.58 and follow the valley of the Inn and its river. As far as Zirl (8 miles short of Innsbruck) the gradients fall on an average of 1 in 250. High up on the north slope of the valley we now see the new electrified Mittenwald Railway, which joins our line at Innsbruck West station. From Zirl to Innsbruck the line falls at 1 in 120. Innsbruck Main station is the most important in the Tyrol, for here the Austrian Southern line forms a junction just west of the station. The architectural features of the Main station are quite pretentious, but there are no platforms, except for a short bay used by the Mittenwald Railway trains, which work through services to and from Munich.

A stay of 28 minutes is made at Innsbruck, where we change the engine and leave at 17.40, and continue to descend the Inn Valley to Wörgl—reached at 18.44. From Innsbruck to Vienna the line is double tracked, and as far as Wörgl we travel over the Sudbahn (Southern Railway), whose "rule of the road" is the same as that of this country. From Wörgl the Sudbahn proceeds north-east to Kufstein, frontier station and junction with the German State Railways. Leaving Wörgl at 18.54, the train now climbs to the watershed separating the river Inn from the River Salzach. Between Hopfgarten and Kirchberg (11 miles) occurs the most interesting scenery, and the line rises in the first 6½ miles at a gradient of 1 in 50. In this section the line ascends in a long curve, affording a remarkable view of the curvature of the route, after which the line eases to a gradient of 1 in 115 to Kirchberg. The rise for the 11 miles is 771 ft. We now descend to Saalfelden, arriving at 21.08. Here the restaurant car which has accompanied us from Bâle is detached, reducing the weight of the train to 288 tons. Leaving 20 minutes later, we continue to descend, and, stopping three minutes at Zellamsee, enter the valley of the Salzach, which we follow to Salzburg. We pass without stopping the important junction, Schwarzach St. Veit, with its route to Trieste (Tauernbahn), and stop for 10 minutes at Bischofshofen (22.40-50). From here to Vienna an alternative route exists to that of which we are about to travel. This is via the Selzthal, and several expresses to and

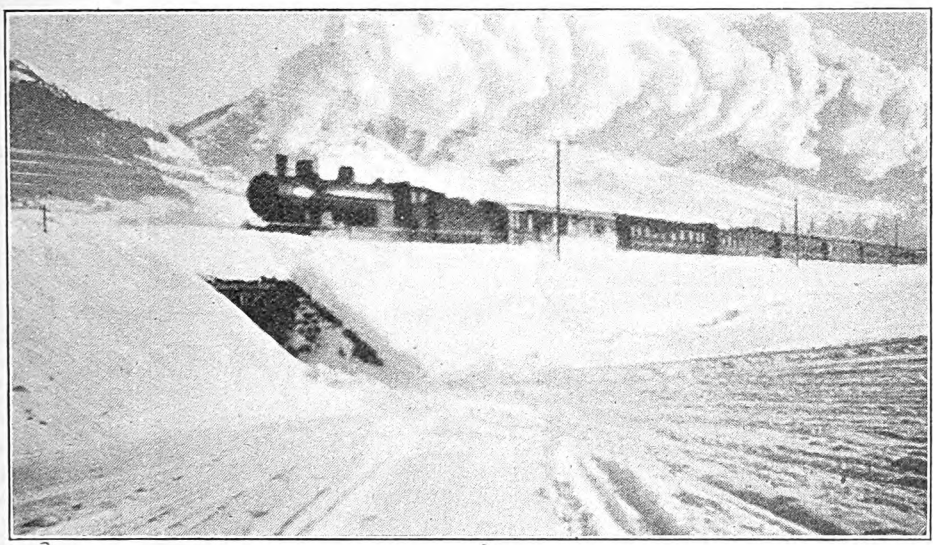

Photo.] PARIS-VIENNA EXPRESS NEAR KITZBÜHEL, IN WINTER. [*H. L. Isaacke.*

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from Innsbruck and Vienna use this route. Before arriving at Salzburg, at ten minutes to midnight, we observe the very large shunting yards, access to which—for goods trains—is provided by a series of flying junctions. Salzburg station lies, roughly, east and west, and consists of one immense island platform with four bay lines at each end, the centre of the station being occupied by the various waiting-rooms, Austrian and German customs, &c. Besides the through lines on each side there are also separate " goods " tracks. This is, perhaps, the most important station in Austria outside Vienna, for, in addition to the exchange of traffic with the German State Railways, nearly all Austrian trains are remarshalled. While this is a " through " station for Austro-German traffic, Austrian trains—whether conveying " through " portions for Germany or not—have to reverse. Gradients in the valley of the Salzach are nowhere easier than 1 in 100, and frequent stretches of 1 in 50 and 1 in 45 are met with. During our stay of half an hour at Salzburg four more cars are attached to the train and one detached, making the weight now 442 tons, and the locomotive is also changed, though for one of the same type (2-10-0). The additional cars are from Munich, one proceeding to Budapest, the others terminating at Vienna.

The line over which we proceed to Vienna has the heaviest traffic of both the past and present Austrian State Railways, and its present post-war traffic is greater than that previous to the " world war."

The new political boundaries of Austria have caused the flow of traffic passing through the Republic to be chiefly east and west, as, apart from the " long-haul " thus gained, geographical conditions in pre-war days favoured the movement of this business north to east and south, and vice versa. As a consequence this double-track line is almost overburdened. The gradients between Salzburg and Vienna, while not very severe, have frequent stretches of 1 in 140 to 1 in 100, and there are three distinct summits, each of which necessitates " banking " with heavy trains.

Our first stop is at Attnang-Puchheim (1.55-2.02), this part of the journey being the nature of a switchback. Proceeding, we reach Wels, also an important junction. Here the line from Passau comes in, and over this route normally the through trains from Belgian and Dutch stations via Cologne and Munich work, running independently to Vienna. After three minutes' stay, we leave at 2.35 and continue downgrade to Linz—in the Valley of the Danube. This is the most important junction station *en route* with connections north to Prague and Berlin and south to Trieste. Arriving at 2.59, we leave in 10 minutes, and, passing the extensive sorting sidings, continue to Amstetten, reached at 4.20, negotiating *en route* the second—and lowest—summit. Amstetten, 72 miles from Vienna, is the outer station of the Vienna local traffic and junction of the route via Selzthal. Leaving at 4.28, we pursue a fairly level course until passing Neulenbach, when the gradient stiffens upwards at 1 in 100 to Rekawinkel, before reaching which we traverse a fine horse-shoe curve—the radius being as small as 936 ft. At Rekawinkel the suburban traffic increases, it being the terminus of a large number of local trains. We now descend at the same gradient to Purkersdorf, passing several small stations and halts. From Purkersdorf the tracks are increased to four (two slow lines being on the south side) and continuing to Hütteldorf-Hacking, at which our train makes a momentary halt to set down only. This station is the terminus of several routes of Stadtbahn (City) railways and has 10 platforms. The present-day service over these lines is greatly curtailed, but some idea of its pre-war importance may be gleaned from the fact that over 900 trains called or passed the station in the 1914 summer services. We now pass in succession the big yards at Penzing and the workshops and sheds of the West station, arriving there at 6.50. Here ends the long journey of 34 hours from Paris. The train is now broken up with the exception of the Budapest coaches, which are transferred to the East station at 8.30, together with other cars from Cologne, via the Connecting railway.

Vienna being the commercial centre of South-Eastern Europe, a review of its railway facilities is now opportune. The city has seven terminal stations, two of which are the property of private railways.

The West station—opened in 1858—is the terminus of the most important traffic entering the city. It has six platforms,

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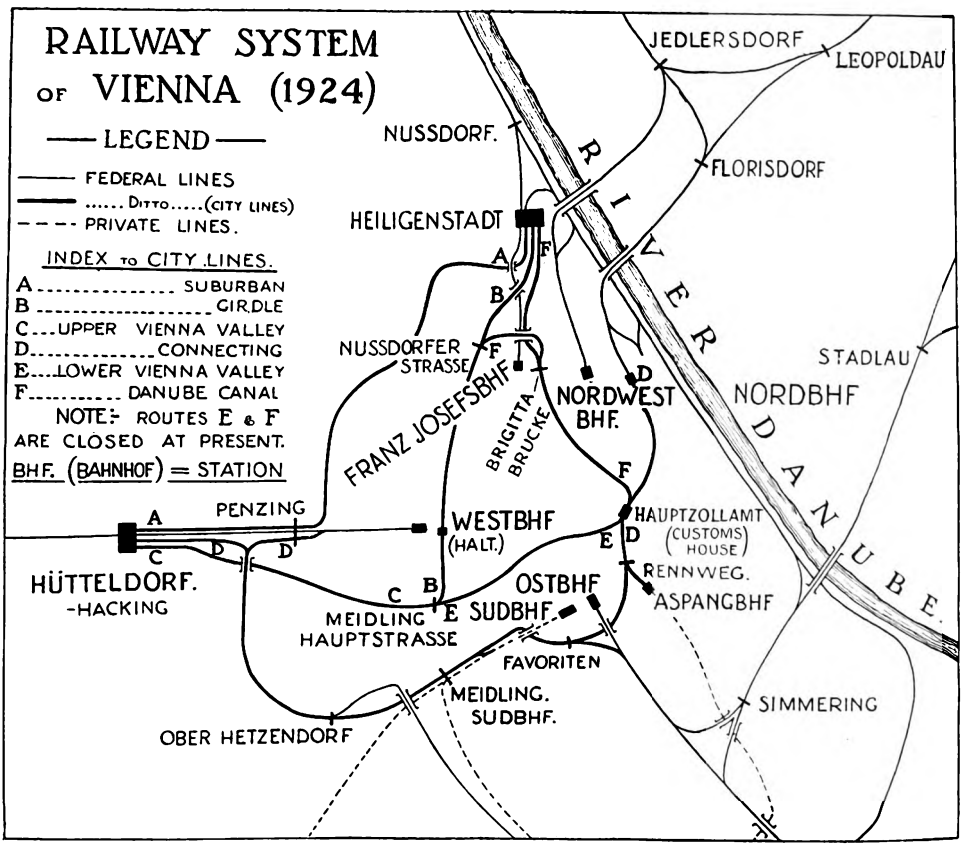
and a large suburban traffic is dealt with here, as the line *en route* to Amstetten passes through the attractive "Vienna Forest" (Wienerwald). Curiously enough, the signalling arrangements at the West station are most primitive, there being only one signal controlling the departure of trains. This is a red flash-light signal with alternate periods of non-illumination, with fixed green light for the "clear position."

which has suffered most as a result of the war, its traffic now being the least of all the stations in Vienna. Previously it served the quickest route to Berlin, and through carriages also ran to and from Flushing, giving the most direct service to London. Its six platforms now accommodate some thirty trains daily.

The North station—opened in 1838—is the earliest station in Vienna. Its finely decorated façade has four castel-



The Franz-Josefs station—opened in 1870—is the route for traffic to Prague and to Carlsbad. It is an ill-lighted structure with two platforms and four tracks. The local traffic dealt with here is of considerable dimensions, as the line serves a number of interesting resorts along the River Danube. In consequence, the Sunday and holiday traffic far exceeds that of weekdays.

The North-West station (1872) for trains to Dresden and Berlin is the one

lated towers, and the interior with its high vaulted roof and decorated tracery give it the appearance of *an ecclesiastical* building, rather than a *railway station*. The length of line from here is now only 50 miles in extent (Lundenburg-Czecho-Slovakian frontier), whereas previously its rails led to the Austrian provinces of Galicia and Bukovina. The traffic from this station is chiefly to Polish destinations and is dealt with at its six tracks, only two of which have platforms.

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The East station (1846), with its eight tracks and four platforms, is the terminus for three routes, one of which, however, is of no importance. One route traverses the south bank of the Danube, while the other, crossing the Danube by a bridge of 15 steel spans, continues on the north bank, both converging at Budapest. The Danube is also crossed by the North-West and North railways with bridges of 18 and 11 spans respectively. The trains from the Western station, with through cars to Budapest and beyond, start from the Eastern station, after having been transferred via the "connecting" railway, to which reference will be made later.

The two remaining stations are the Aspang, of the railway of the same name, a local line with little importance, and the South. This station is the head-quarters of the Austrian Southern Railway, and from here the trains for Trieste, Italy and Belgrade start. It was opened in 1841, and a heavy traffic is dealt with at its seven platforms. The architecture of all the Vienna terminals is distinctly meritorious, the absence of advertisements, &c., giving each the appearance of a fine public building. The city railways referred to already form an important part of the transportation of Vienna. Two lines originate at the station of Hütteldorf-Hacking, and unite again at Heiligenstadt, an important junction with nine platforms and the first station north of Franz-Josefs station. There is also a third route between these points, the major portion of which is at present closed, owing to the war, but plans are in operation to reopen same. The most important of the City railways is the connecting line, which originates at Penzing and connects all the terminals in Vienna except the North-West and Franz-Josefs stations. This was opened in 1872, and though entirely within the city of Vienna, the gradients are so severe as to necessitate the banking of all trains over 200 tons. For the working of the traffic over the City railways, four-wheel stock with open centre gangways are used. Heavy tank engines provide motive power throughout the Vienna local services. Ten-car trains are run during the normal hours, and in the "rush" periods 12-car trains. First-class cars do not work in the City services, with third-class only on some routes. The number of trains over the City railway compares very unfavourably with that of pre-war days. Heavy competition from a splendid system of tramways is one of the causes, but the lack of coal is the greatest obstacle to the reintroduction of extensive services. Admission to the platform for others than passengers is by platform ticket, and this regulation is stringently adhered to, and, further, the holder of such a ticket is mulcted to the extent of kr. 30,000 if he is found occupying a seat in the train. For the City railways a universal fare exists between groups of stations, and a ticket issued at any station is available for any other. The cost of such a ticket is approximately 4d., as against 1½d. by the tramways.

To fairly judge the condition of the Austrian Federal Railways as they are to-day, one must take into consideration the condition of the Austrian State Railways—as they were previously called—immediately after the armistice. They were then in a deplorable state, Austria having lost 72 per cent. of her railway mileage and the major portion of its rolling stock. Statistics were not available till the summer of 1920, when the number of express trains (*Schnellzüge*) arriving and departing at all the Vienna terminals was less than 10 per day. This figure had increased in 1921 to 35, and 1923 to 71. The writer has conversed with people who had on many occasions, when travelling during 1920, to wait for periods as long as 23 hours to purchase their tickets, only to find that the accommodation consisted of a train of four-wheel coaches with nearly every window smashed, lights absent, and upholstery almost beyond repair. Now all this is changed since Austria has received, as a result of the railway rolling-stock conferences, her proper quota of locomotives and bogie stock. The locomotives seem efficient for their work, though there is a large number of older engines to be seen, especially on the branch lines and in the banking of heavy trains. The carriage stock has been renovated, but has been mostly confined to making good the upholstery and woodwork destroyed by the ravages of the war. The pre-war Austrian bogie cars working through to other countries at the present time are far below the standard, the lighting is poor, and the sanitary arrangements

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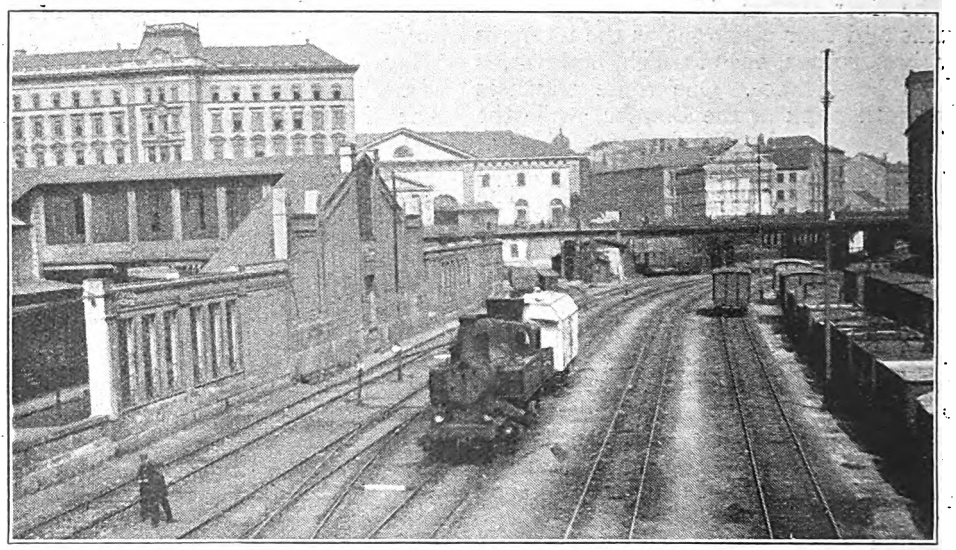

Photo.] CUSTOMS HOUSE STATION, VIENNA. [*E. J. Miller.*

therein are sadly in need of improvement; their condition is aggravated by the extraordinarily bad coal used of necessity, since it is obtained from Czecho-Slovakia under the terms of the Peace Treaty. The through carriages are 37 to 40 tons weight and have two first-class and five second-class compartments, two lavatories, and a service compartment. A number of new cars have been turned out during 1923. These are equal in every respect to the continental standard. The four-wheel stock used on the local services are open-ended and have centre gangways. Some of these are fitted with a unique door which can be opened from *each side*, left- or right-handed. The standard colour appears to have been green, but it need hardly be mentioned that the rolling stock has not been repainted for many years. It is curious to observe the variety of ownership marks which appears on some of the stock. In some cases as many as four sets of initials are to be seen. The Southern Railway stock is incribed in German-Slav-Hungarian and Italian designations.

The operation of the larger stations could be improved, especially for the passenger. Lists of train departures and arrivals are either incomplete or non-existent. Admission to the platforms appears to take place from several parts of the station, according to the importance of the train. However, some guide is given by the significant sign "No pushing. Seats enough"! It is therefore very necessary to arrive early at the station, particularly since the system of seat reservation was abolished in July, 1923. The permanent way in most areas is good and well ballasted—extensive renewals are being made in many parts, especially in Tyrol and Vorarlberg, where they cover a considerable mileage. On the lines east of Vienna leading towards Czecho-Slovakia and Hungary, over which the traffic has diminished very greatly, the condition of the tracks is poor, and the sidings—often entirely hidden by vegetation—are the recipients of large numbers of derelict goods vehicles, the condition of which is melancholy to behold.

Between Bludenz and Landeck the electrification project of 1913 is now being proceeded with, and the erection of the overhead equipment is nearly complete.

The signalling of the main routes outside of the station limits is good, each station usually having two signal boxes, the signals comprising starters, distance and homes.

The foregoing remarks concerning the condition of the Federal Railways apply generally to the Austrian Southern, which in all particulars appears more prosperous and better managed. The signalling on

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this line specially is up to date, and at all the larger stations "platform-starters" are used.

In the Vienna local area an extensive series of "flashlight" signals is in operation, with varying combinations of flashes and colours to indicate home, distant, and distant repeaters. The Austrian railways have not the same general efficiency and material prosperity as those of Czecho-Slovakia, of which the writer has some experience.

It is obvious that with the relative value of money in these two countries that the Austrian Government, in operation of its railways, labours under tremendous difficulties. Despite the sad condition of the Austrian railways at the date of the armistice, their progress since has been remarkable—under the many adverse circumstances they are moving forward rapidly towards the pre-war standard.

At the moment of completing this, it is topical to refer once again to the Arlberg Railway. This was entirely closed on December 26, owing to the avalanches which fell upon the line. These are the worst in depth and extent since the opening of the line, and blocked all traffic till the reopening on January 9. The Christmas mails for Austria and beyond arrived in Switzerland 14 days late, having been snowed up *en route*. It is interesting to observe that, anent the remarks in the early part of this article, the Orient Express and the daily Paris Express were temporarily detoured via Munich and Lindau. Following hard upon this, on January 13, a serious accident occurred. The last 14 vehicles of a goods train approaching the station of Danöfen broke loose, as the result of the coupling breaking. The hand brakes being of no avail, these vehicles ran down the gradient 1 in 32 at tremendous velocity. Through the presence of mind of the station chief of Dalaas—the station in the rear—the runaway vehicles were diverted on to a siding. The smash was tremendous and the debris higher than the station buildings. This prompt action saved a serious disaster to the Orient Express, which was then approaching Dalaas.

The writer extends his cordial thanks to the chief officials of the Austrian Railway Ministry and to Herr E. Hildbrand, of St. Gallen, for information utilised in this article.

CORK, BANDON AND SOUTH COAST RAILWAY.

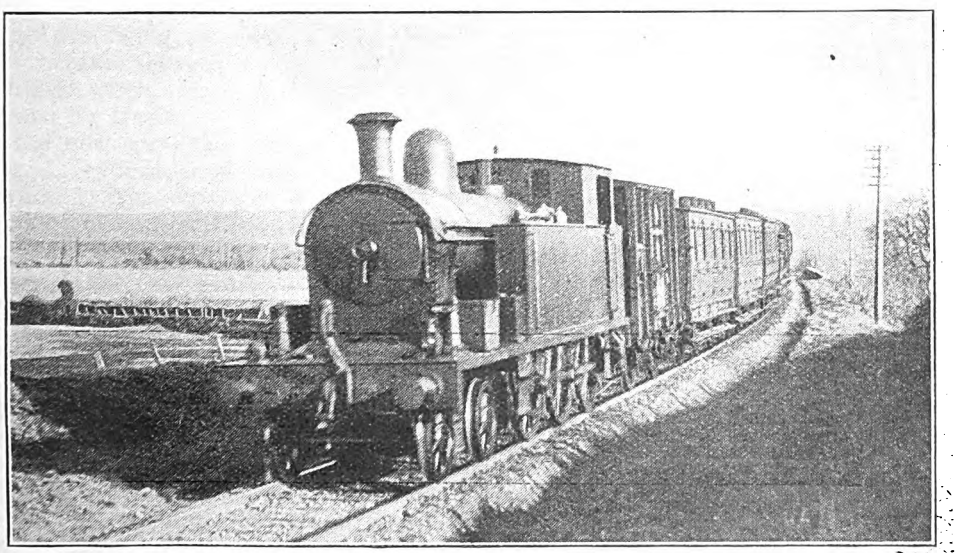

Photo.] Cork–Baltimore Train near Cork, 4-6-0 Tank Engine, No. 9. [*Rex Murphy*.

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THE RAILWAY PORTRAIT GALLERY.

Mr. E. FORD,

Chief Goods Manager,
Great Western Railway.

MR. ELIAS FORD, who has been appointed Chief Goods Manager of the Great Western Railway in succession to Mr. Edward Lowther, J.P., has held the office of Deputy Chief Goods Manager since June, 1921, and for three years previously was Assistant Chief Goods Manager. Entering Great Western Railway service in 1884, at Plymouth, he was removed in 1890 to Paddington. In 1895 he was transferred to the personal staff of the General Manager. After holding appointments at Worcester and Cardiff, he became District Goods Manager at Cardiff. In 1918 he became Assistant Chief Goods Manager.

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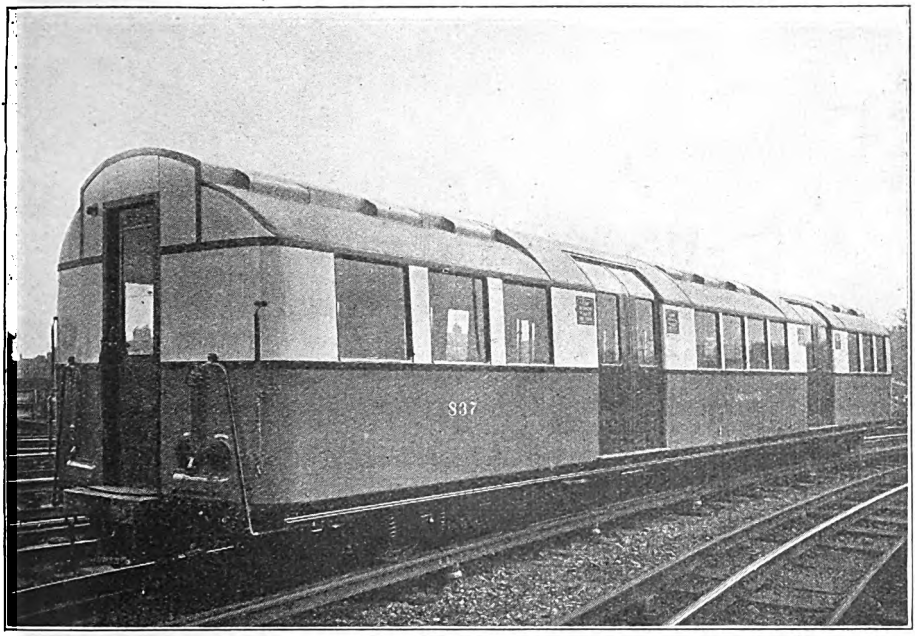

EXTERIOR OF NEW "UNDERGROUND" COACH.

New "Underground" Rolling Stock.

TWO hundred cars of an entirely new and more comfortable design are being placed in service for traffic between Hendon and Moorgate Street when, during April, this route is opened for traffic.

In the new cars, the principal features of the six experimental cars which were constructed by separate makers and entered for competition in 1922 are embodied, with further developments. Several of the cars are already in daily service upon the Hampstead line, and deliveries are being made rapidly of the remaining cars.

In view of the long distances which the new rolling stock will have to make—from Edgware to Morden eventually—no effort has been spared to make them as comfortable as possible. The seats are upholstered in fawn-coloured plush and are of spring designs. More cross-seats have been fitted, it being found that many passengers prefer to travel facing the direction of motion. The lighting is scientifically planned, 20 per cent. more powerful than in the ordinary "tube" cars and more evenly distributed. No shadows are cast and the lights are shaded.

There are no platforms at the ends of the cars, the space usually devoted to them being added to the passenger accommodation. Each trailer-car now seats 48 as against 52 in the old cars. Instead of entrances and exits at the ends of the carriages, there are two double pairs of doors on each side of the car. Each pair of doors is 4 ft. 6 in. in width. The means of ingress and egress is thereby considerably increased, and speedy loading and unloading are facilitated. The doors are air-operated and the driver does not receive the starting signal until all are closed and locked. The edges of the doors are fitted with soft rubber, and mechanism is fitted whereby the speed of the door is gradually retarded as they come together. The pressure during the last six inches of the

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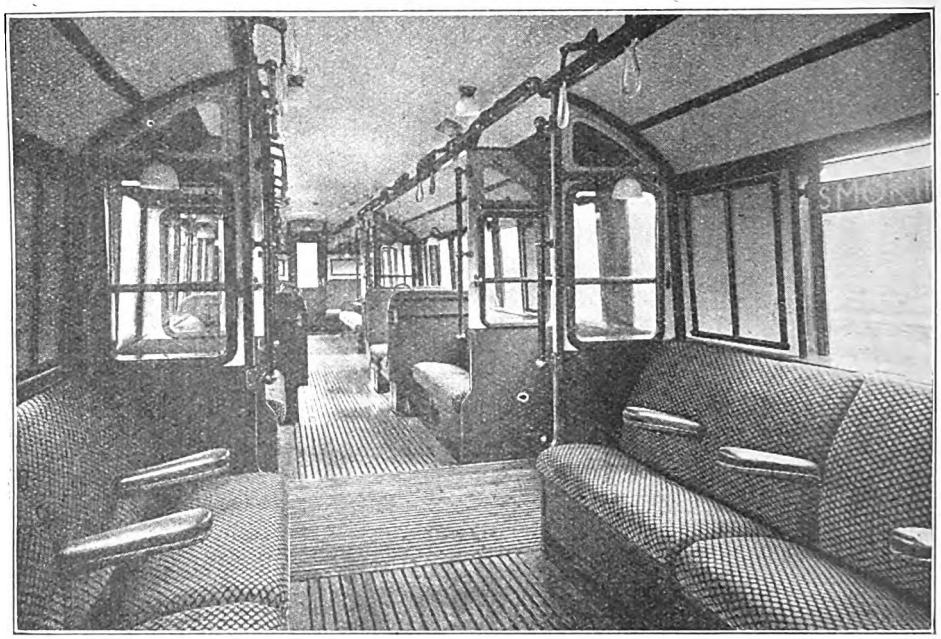
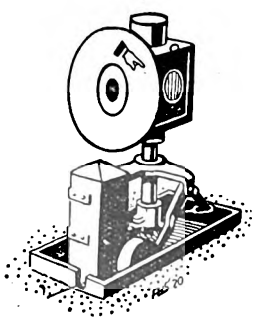


AN INTERIOR VIEW OF THE NEW "UNDERGROUND" COACH.

"stroke" is such that a passenger could not receive any injury if he happened to be caught between them.

One of the most important features of the new vehicles is that they are quieter running. The steel sides of the cars are now lined with thick asbestos facings, as also are the floors. By this means much of the familiar roar has been absorbed. Conversation in normal tones is now possible. Another important point is the more even acceleration and higher speeds which this new rolling stock can attain. An average speed of 19 m.p.h., including stops, will be maintained, as against the present best speed of 18 m.p.h.



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STEAM LOCOMOTIVES.

Fig. No.	Type of Engine.	Years Built.	No. of Cylinders.	Cylinders, Diameter and Stroke.	Coupled Wheels Diameter.	Wheelbase Rigid.	Total Engine Wheelbase.	Total Heating Surface.	Grate Area.	Working Pressure.	Weight Engine in Working Order.	Adhesion Weight.	Weight Engine Tender in Working Order.	Tractive Force (lb.) at 85 per cent. Boiler Pressure.
				in. in.	ft. in.	ft. in.	ft. in.	sq. ft.	sq. ft.	lbs. per sq. in.	T. C. Q.	T. C. Q.	T. C. Q.	lbs.
1	4-4-2	1911-1918	3	16½ × 26	6 10	7 7	29 6	1,875·4	27	175	79 4 0	40 14 0	125 16 0	19,300
2	4-6-2	1922	3	19 × 26	6 8	15 0	37 2	2,874·6	415	200	101 10 0	60 0 0	148 2 0	29,918
3	4-4-2 (uniflow)	1918	3	16½ × 26	6 10	7 7	29 9	1,875·4	27	175	81 4 0	40 12 0	127 16 0	19,300
4	4-6-0	1911-1918	2	20 × 26	6 1¼	14 0	26 0½	1,730	23	175	71 2 0	53 18 0	115 2 0	21,155
6	4-6-0	1920-1922	3	18½ × 26	5 8	13 6	27 8	1,958	27	180	77 14 0	58 14 0	124 6 0	30,312
7	0-8-0	1919	3	18½ × 26	4 7¼	18 6	18 6	1,958	27	180	71 12 0	71 12 0	115 14 0	36,909
9	0-6-0	1920-1922	2	18½ × 26	4 7¼	16 6	16 6	1,326†	20	180	49 10 0	49 10 0	87 2 0	24,642
10	4-4-4 T	1913-1922	3	16½ × 26	5 9	8 0	34 6	1,252·9	23	175	87 6 4	39 19 0	—	22,940
11	0-6-0 T	1921	2	17 × 24	4 1¼	13 8	13 8	731	11·3	140	38 12 0	38 12 0	—	16,760
12	4-6-2 T	1910-1911	3	16½ × 26	4 7¼	14 6	34 3	1,080·3*	23	160	87 10 0	55 10 0	—	26,140

* Total heating surface, non-superheater engine, same class = 1,648 sq. ft.
† ,, ,, ,, ,, ,, ,, ,, = 1,599 sq. ft.

ELECTRIC LOCOMOTIVES.

Fig. No.	Type of Engine.	Years Built.	Wheels Diameter.	Wheelbase Total.	Voltage.	System.	Total h.p.		Weight in Working Order.	Tractive Effort.	
							One Hour.	Continuous.		One Hour.	Continuous.
			ft. in.	ft. in.					tons cwt. qr.	lbs.	lbs.
5	(passenger) 4-6-4	1922	6 8 and 3 7¼	43 8	1,500	D.C.	1,800	1,300	110 1 0	15,900	9,480
8	(freight) 0-4-4-0	1914	4 0	27 0	1,500	D.C.	1,100	635	74 8 0	19,600	10,400

Particulars of Locomotives built for Service on the North Eastern Railway between 1910 and 1922, by Sir Vincent Raven, K.B.E., Chief Mechanical Engineer.

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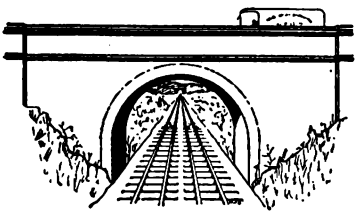
Edward Fletcher, for many years Locomotive Superintendent of the railway, and subsequently having passed through various positions, Sir Vincent Raven was appointed Chief Mechanical Engineer in 1910. His policy in the designing of locomotives was noteworthy for its bold lines, his main line engines being of large size with ample boiler power and tractive effort, and during his regime at Darlington he designed and built three-cylinder simple engines for express passenger and other traffic, which showed to great advantage on the heavy duties allotted to them. In the early part of 1913 there was completed at the Darlington Works of the North Eastern Railway a 4-6-0 type express passenger locomotive equipped on the "Uniflow" system, and later one of the "Z1" class engines was similarly fitted. The principle of the "Uniflow" (Stumpf) method of steam distribution consists chiefly in the avoidance of any return or backward motion of the steam from leaving the boiler to its escape after completing its work in the cylinder. The "Raven" steam locomotives on the North Eastern Railway comprised numerous classes for passenger, goods and shunting service, and some of these are illustrated.

Sir Vincent Raven's name during more recent years has become prominently identified with railway electric traction, on which subject he is regarded as one of the leading British authorities. He, in 1921, designed a powerful electric express passenger locomotive, the construction of which was proceeded with, the mechanical portions being built at the company's works, Darlington, and the electrical portions at the works of the Metropolitan-Vickers Electrical Co. Ltd., at Trafford Park, Manchester. This locomotive has run trials on the Newport-Shildon line of the London and North Eastern Railway, which is electrically equipped and on which electric freight locomotives, also designed by Sir Vincent Raven, are handling goods traffic daily. It will not, however, be until the main line is electrified that the express locomotive will have an opportunity of showing its real capabilities.

During the war period, namely, from 1915 to 1917, Sir Vincent Raven was Chief Superintendent of the Arsenal factories at Woolwich, also holding the position of Controller of Armament Production to the Admiralty in 1917, in which latter year his name figured among those selected for knighthood in the New Year's honour list. In the years 1902, 1909 and 1920, Sir Vincent visited the United States of America to inquire into railway working generally, and the information thus obtained was doubtless of great value to him in subsequent years. The first installation of electric dock cranes in England was carried out at Middlesbrough Docks under his supervision, after visits had been made by him to Antwerp and Hamburg.

In addition to being a Vice-President of the Institution of Mechanical Engineers, Sir Vincent Raven is a member of the Institution of Civil Engineers, and also of the Société des Ingénieurs Civils de France. He is also on the Advisory Committee of the Science Museum, Kensington, and the Main Committee of the British Engineering Standards Association. In 1915 he was elected a Town Councillor of Darlington.



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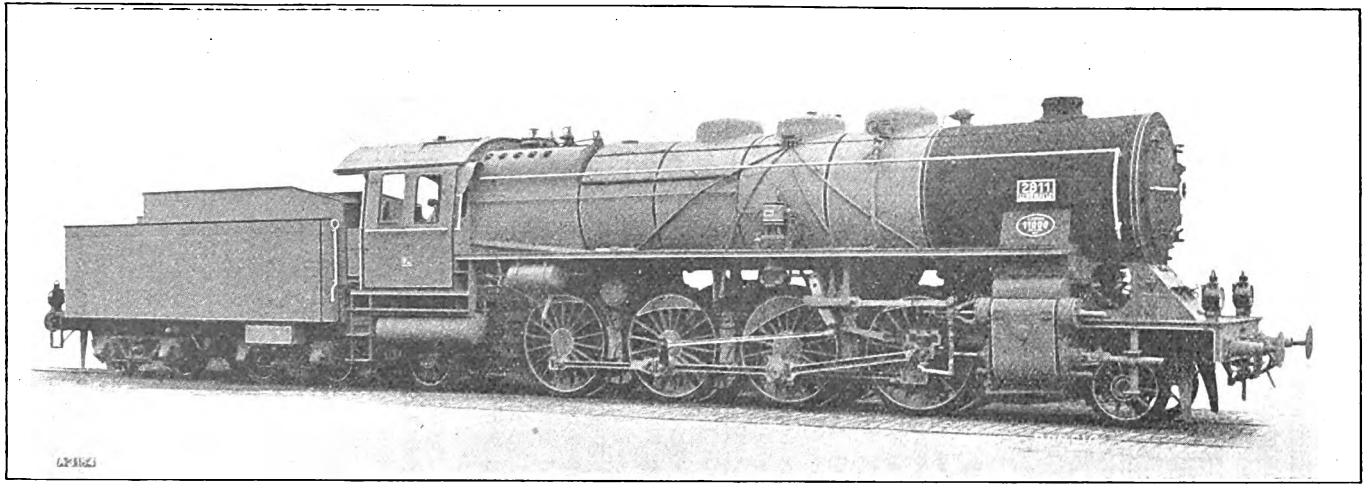
3-CYLINDER 2-8-2 EXPRESS PASSENGER AND FAST FREIGHT LOCOMOTIVE, GERMAN STATE RAILWAYS.



THE photograph reproduced herewith shows a new 3-cylinder, simple, 2-8-2 type locomotive recently completed by the firm of A. Borsig, of Berlin-Tegel, tor the German State Railways. The engines of this class have been introduced for hauling express passenger and fast freight trains. This is the 11,000th engine turned out by the firm named, and was built to their own design under the supervision of the Central Railway Office, Berlin. Leading particulars are:—Cylinders (3), 20½ in. by 26 in.; wheels, coupled diameter, 5 ft. 8¼ in.; boiler heating surface, 2,358 sq. ft.; superheater surface, 875 sq. ft.; grate area, 42·6 sq. ft.; working pressure, 200 lb. per sq. in. The engine weighs in working order about 102 tons, or with the tender, 166·9 tons.

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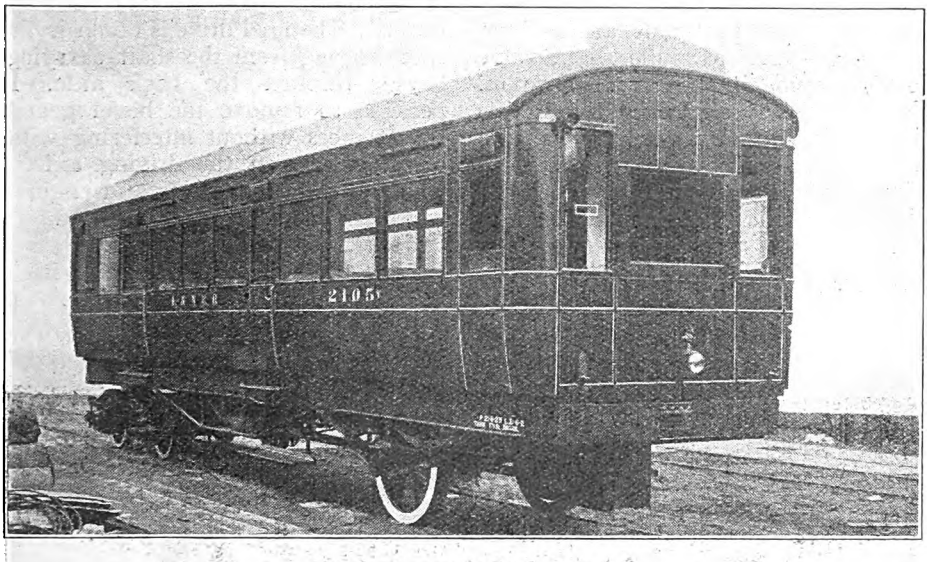

GENERAL VIEW OF CAR.

Petrol Rail Motor-Cars on British Railways.

IT is not for want of trial that the petrol-engined rail motor-car has not, so far, become a standard feature of British railway practice. Indeed, at one time or another, and including both petrol and petrol-electric designs, but omitting light inspection cars such as the Drewry and other types and small works and shunting engines, of which considerable numbers are in use at home and especially abroad, many such vehicles have been subjected to exhaustive trial. Thus, some twelve or fifteen years ago, the Great Northern Railway had a petrol car in service, the Great Central, London and North Western and Great Western petrol-electric designs, and the North Eastern both petrol and petrol-electric vehicles, besides special adaptations such as the car used for conveying passenger and motor-cars across Connel Ferry Bridge, Ballachulish Extension, Callander and Oban Railway.

One or two of these cars, if not more, are still in use, but recent experiments with the adapted omnibus type, to which the name "railbus" has been given, have revived interest. Attention has been given to this matter particularly on the North Eastern Railway, which has several railbus services. On the basis of experience thus obtained as to the traffic-producing possibilities associated with the increased local and between-station facilities which can thus be given, several cars of a larger type have been constructed at York, including various phases of practice.

In the January number a petrol-electric car in use in the Harrogate district was illustrated. Now, by the courtesy of Mr. W. M. Teasdale, Advertising Manager, London and North Eastern Railway, we are able to illustrate and describe a petrol vehicle constructed last year at York, and used in that district. The car has a length of 38 ft. over headstocks, provides seating accommodation for 40 third-class passengers, and weighs 17 tons 5 cwt. There is an entrance gangway where a small amount of light luggage can be carried. As the car is not intended to be run with other vehicles attached, it is not provided with buffers or drawgear, except an emergency arrangement for hauling the car in case of breakdown.

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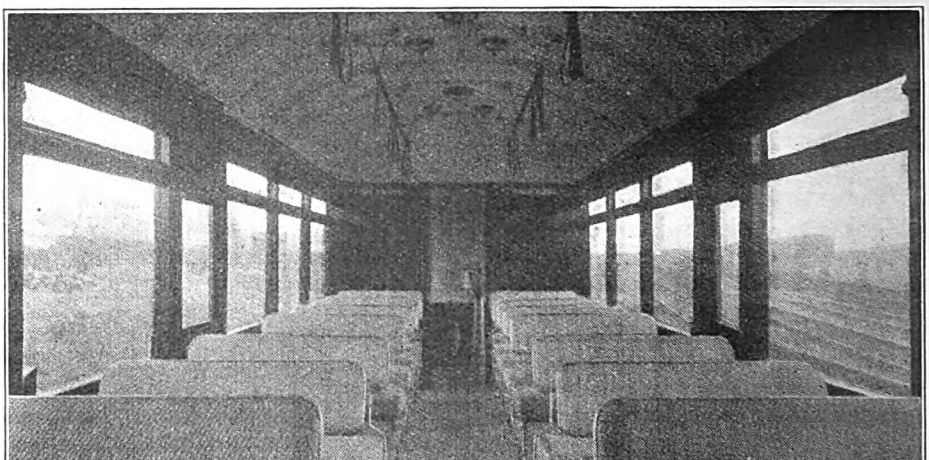
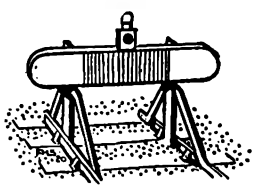
The engine compartment at one end contains a six-cylinder Daimler sleeve-valve engine developing 100 h.p. at 1,200 r.p.m. Dual ignition is provided and petrol is fed by gravity from two tanks of suitable capacity. Two gulled-tube radiators are provided, one at each end, arranged for use in series through the engine. Power is transmitted to a three-speed gear box through a multiple disc fibre and steel clutch. The drive is thence taken by bevels. The final drive is taken by heavy spur bearing from the shaft carrying the bevels through the back axle. It is possible to remove the bevel gears and thrust races without interfering with the coach wheels on the driving axle. The whole of the change gear and engine control mechanism, &c., is duplicated.

At the further end of the car is a smaller driver's compartment with complete control equipment. The car is



INTERIOR OF CAR

propeller shaft through two universal joints and hollow torque tube to the back axle. Situated in front of this axle and forming part of the torque tube is the reverse arrangement formed of two bevelled gears permanently in mesh with a bevelled wheel on the end of the propeller shaft, the reverse being obtained by a double dog clutch acting between these fitted with the Westinghouse brake, compressed air for which is supplied by a small pump fitted in tandem with the engine. A speed of 40 m.p.h. can be maintained on the level, and 30 m.p.h. on any reasonable gradient. The car has for some time past been working between York and Strensall, and has efficiently worked the services scheduled.



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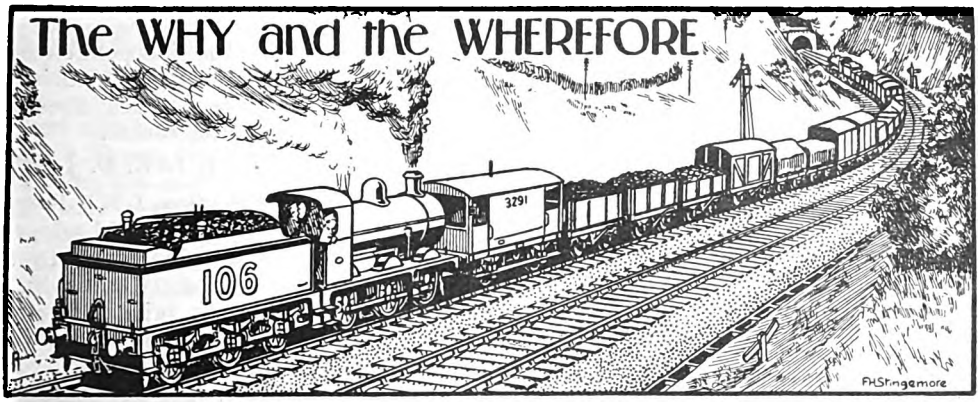

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, *33, Tothill Street, Westminster, London, S.W.1. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition* (1924) *of this standard railway reference work is in preparation; it will be published before the end of April. All previous Editions are out of print.*

Midland Division Locomotives, L.M.S.R.

Old Midland numbers 2303 and 2311 are given to S.M.J. locomotives Nos. 7 and 18. The remark in the article in the February number in regard to old number 2315 will be clear if the word "unaltered" is corrected to "unallotted," as was intended. You have apparently misread the paragraph with regard to 11 renumbered engines between Nos. 2320 and 2366. These are now carried by the 11 North Staffordshire engines mentioned. The reference to 13 engines resulted from numbers 162 and 164 being repeated at the end of the list.

We cannot go into the considerations which induced the authorities to classify the engines referred to as stated. The general principles were, however, outlined in the February number. Your remark is noted that Midland 0-6-4 tank engines Nos. 2035 and 2039, rebuilt and superheated, are, or were until recently, stationed at Bournville and used for Birmingham–Leicester expresses, as well as on local duties.

[Reply to G. W. BISHOP and T. A. P.]

Carstairs Junction, L.M.S.R.

Through trains between Carlisle and Edinburgh, not calling at Carstairs, run via the Strawfrank spur, which leaves the Glasgow–Carlisle line 28 chains south of Carstairs station and joins the Carstairs–Edinburgh line at Dolphington Junction, 26 chains east of Carstairs. Trains between Carlisle and Edinburgh, which run into Carstairs station, or are there detached from or attached to through Glasgow trains, involve reversal. Some of the dual trains to and from the south stop at Strawfrank Junction instead of Carstairs station to detach or attach the Edinburgh portions, in which case no reversal of direction is involved. Similarly, certain trains from Edinburgh with portions for the Glasgow direction and towards Symington are divided at Dolphington Junction. There are also combined Carlisle, Edinburgh and Glasgow trains which divide or combine at Symington, in which case the Edinburgh portions travel via the Strawfrank spur.

[Reply to "ENGINEER."]

Great Western Railway Locomotives.

Mr. A. H. Hastie points out that 4-4-0 engine *Earl Cawdor* was originally built about 1900, as No. 3297, and fitted with a large cab with side windows, a high pitched boiler of considerable diameter fitted with round-topped firebox and a brass dome. The engine is now, however, rebuilt to correspond with the "Flower" class, except that the construction of the

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frame and certain details differ somewhat from the engines to which it is now similar in most respects. Mr. Hastie mentions a photograph, taken about 1918, showing the engine in her rebuilt condition, working the Paddington–Worcester express. Mr. W. R. Clayton sends a photograph (not reproduced) taken in 1923, showing the engine leaving Bristol with the Liverpool and Bradford to Plymouth through express. A Devonshire reader, "Langford Court," states that he travelled recently behind this engine.

[Reply to R. M. SOWERBY.]

Through L.M.S. Service, Lancashire to Eastern Counties.

During last summer this train was made up of two portions, both of North Western stock and including luncheon car; the latter was in the Liverpool portion, which called at Crewe to Stoke-on-Trent, where it was joined by the Manchester portion, stopping intermediately at Stockport. From Stoke the train ran via the N.S. main line through Uttoxeter and Willington Junction, and thence on to the Midland via Castle Donington and Trent to the next stop at Nottingham. After that the train ran forward via Melton and Saxby on to the Midland and Great Northern Joint Line, to stop at Bourne, South Lynn, Melton Constable and principal stations to Cromer, Yarmouth and Lowestoft. During the winter the times are still operative between Liverpool, Manchester and Nottingham, but not beyond.

[Reply to MAJOR J. A. DANE.]

Engine Cab Lights.

Abroad engines are sometimes fitted with electric headlights, in which case it is a natural development to provide small electric lamps where required in the engine cab, and it would be practicable to use hand lamps in place of the usual enginemen's flare lamps. Ordinarily, however, electric current is not always available, or if it is, it cannot be depended upon at all times, while battery sources of current are not favoured. For these and other reasons the old oil lamps are still used, and enginemen employ the old type of flare lamp. In some sheds, however, portable electric lamps are used for examination. Some signal lamps are electrically lit, but here also the independence of individual lamps is a factor causing a preference for a system which does not depend upon a collective source.

[Reply to E. D. J. M.]

Great Central Section, L.N.E.R.

It is not clear why you should adopt so pessimistic an attitude in regard to the prospects of this section. Obviously, as its main line traffic is principally concerned with facilities between London, Leicester, Nottingham, Sheffield, and thence to Manchester, it is not so largely concerned with tourist and holiday facilities (which naturally are most extensively advertised) as the Great Northern and Great Eastern sections. It has, however, quite a valuable main line traffic of its own, both intermediate and through, and numerous facilities, both ordinary and excursion, are given via this route, sometimes as alternatives to those from King's Cross, in others because the Great Central route is the most convenient and suitable therefor.

[Reply to R. D. JAMES.]

4-6-4 Express Engines, C. de F. du Nord.

These two locomotives, developed from a previous engine of the 4-4-4 type, were originally designed in order to test the possibilities of a special water-tube firebox, built on the same general lines as a stationary water-tube boiler. Space would not permit a description of this speciality in detail, but it may be mentioned that it was the size of this special firebox that compelled the use of a trailing bogie for its support. These fireboxes were not, however, altogether successful, and the great weight of the engines concerned was also against them; further, the present "Pacific" design has proved itself capable of the maximum demands of the fast boat services, as well as those northward from Paris. The 4-6-4 design is not, therefore, likely to be perpetuated.

[Reply to G. F. FENINS.]

Somerset and Dorset Light Railway.

Mr. Cecil J. Allen will doubtless deal with locomotive performance over the main line of this railway in due course. We note that a good proportion of the important expresses are now hauled by the large superheated 0-6-0 locomotives,

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and agree that their systematic use in this way is somewhat unusual in regard to an express passenger service. The fastest booked runs on the winter service are those of the 3.30 p.m. from Evercreech Junction to Poole, 40½ miles in 54 min., and the 12.25 p.m. from Blandford to Evercreech Junction, 26¼ miles in 35 min., average speed in both cases being 45 m.p.h., which is excellent over what is mainly single line.

[Reply to O. B. MORLAND and J. C. ELWES.]

Southern Railway and Water Troughs.

Were there need for water troughs on the London and South Western main line, no doubt they would be provided. As the non-stop runs are not of extreme length, there would not be much gained by their introduction. The fact that engines have to draw up to the water column of stations like Southampton (West) is a necessity which cannot be avoided if water has to be taken, but even although certain trains might avoid this necessity, were water troughs available, there would always be many engines, especially those working trains on the miscellaneous routes which centre upon so many of the principal stations, to do so, in that they would either not be fitted with water scoops or would be taking routes not provided with water troughs.

[Reply to A. L. BAKER.]

Inner and Outer Home and Distant Signals.

Outer home signals are provided either to enable trains to be brought further forward than would be permissible under other circumstances, as when approaching a junction where a train on the converging route has already been accepted, or to safeguard shunting and other operations within a greater distance than is protected by the ordinary home signal. Inner and outer distant signals are provided in cases where it is desired to give an indication as to where the route is clear through the section in advance, under conditions where either a distant signal at the usual position would not be visible sufficiently far away or the outer distant signal is so situated that if a clear indication cannot at times be given at that point the required information shall be given at a more advanced point by the inner distant signal.

[Reply to E. S. JONES.]

Renumbered Locomotives, L.M.S.R.

Seeing that the combined locomotive stock numbers considerably over 10,000, it would, obviously, be impossible for space to be devoted to complete particulars of the engines individually. To some extent, the engines are numbered in series, but otherwise, and especially in the case of late L.N.W.R. locomotives which had few classes to which consecutive series of numbers were given, it is not possible to ascertain the old numbers for comparison with the new. Particular engines mentioned are, we believe, still engaged on turns which bring them to London, but, as we have more than once explained, we cannot give information as to the sheds to which they are attached or the trains they work, owing to the fact that before publication can be given a change is always likely to have occurred.

[Reply to W. H. B. and others.]

Locomotive Shed Indications, Southern Railway.

The letters shown at the front end of the main framing of London and South Western locomotives indicate the sheds to which the engines are attached, in the form of abbreviations of the names of the respective centres. In most cases they suggest their application. This matter receives attention in the RAILWAY YEAR BOOK. As you will have seen, the colour scheme to be adopted by the Southern Railway for locomotives and rolling stock has now been decided upon, though your letter is the first to refer to Brighton section engines appearing in the new style. We note also that some new South Western section engines are appearing numbered 473, &c.

[Reply to "TAUNTONIAN" and R. A. HARDY.]

P.L.A. Railways.

Passenger train services between Millwall Junction and North Greenwich are worked at present, we believe, by a steam rail motor car purchased from the Great Western Railway, though, previously, P.L.A. engines and vehicles were used. As this and associated dock lines belong to the Port of London Authority, obviously, although worked in association with the late Great Eastern Railway, they are not affected by the inclusion of

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the Great Eastern in the London and North Eastern Railway. We would suggest that you make a trip over the line, as you reside close to London, and obtain information in regard to the remainder of your query yourself.

[Reply to V. W. ORFORD.]

Power of Locomotives.

As shown by the tractive power formula, the Great Western engine, No. 4073 *Caerphilly Castle*, is more powerful than either the Great Northern or North Eastern "Pacifics," L.N.E.R. Tractive power is, however, only one factor in estimating locomotive power, so that the latter two designs have the benefit of greater boiler capacity, although steam pressure is lower than that of the Great Western engine. There are 12 Great Northern and two North Eastern "Pacifics" now in service, and 40 of the former design on order. The 4-6-2 engines do not at present work on the Doncaster–Leeds branch.

[Reply to F. W. JOHNSON and "MIDLAND."]

Adhesion Weight.

As actual weight on any pair of locomotive wheels depends in large measure on the adjustment of the springs, which is effected over a suitable locomotive weighbridge as one of the final operations before the new engine takes the road, it is impossible to calculate precisely what the adhesion weight will be. In the drawing office approximate weights are calculated, and by the adjustment just referred to actual weights are adjusted as nearly as possible to calculated, but there are often material differences between the original estimated weights, and the actual final weights, in the case of a new type.

[Reply to T. D. CARNWATH.]

4-6-2 Locomotives, L.N.E.R.

You are correct in assuming that, including twelve Great Northern and two North-Eastern 4-6-2 locomotives already in service, a total of 54 engines of this type are provided for in the L.N.E.R. locomotive-building programme. Twenty to be built at Doncaster have already been mentioned in a previous reply, while a further 20 are to be built in Glasgow. Your other remarks indicate a point which has been carefully considered, and, so far as space will permit, we hope to be able to supply information on the lines suggested.

[Reply to "GAINSBOROUGH" and "PERCONTATOR."]

Lancashire and Yorkshire Locomotives.

To our knowledge the Wootten firebox has never been used on the late Lancashire and Yorkshire Railway. Possibly you may be thinking of the corrugated fireboxes fitted by Mr. H. A. Hoy to some of his 0-8-0 mineral engines, but these were *circular* fireboxes, and were not spread out over the frames. They certainly gave a distinctive appearance to the engines concerned, however, and earned for them the irreverent designation of "Sea-pigs." These fireboxes were not a great success. We have no information in regard to the book you mention.

[Reply to "FELIX."]

Colours of Locomotives and Rolling Stock.

Seeing that these are selected officially, no good purpose would be served by discussing whether the liveries which have been decided upon by the respective railways might be improved. It may be pointed out, however, in regard to the choice of different greens for engines and passenger vehicles, that different conditions apply. It may be that, were the same colour used, they would present different appearances, while the conditions of working may introduce complicating factors, so that a colour suitable in one case would be unsuitable in another.

[Reply to A. W. H. L.]

Great Western Railway Locomotives.

We cannot call to mind any book devoted exclusively to broad-gauge locomotives, but most of the works which deal with locomotives from the historical point of view contain extended reference to them. Volumes concerned with the Great Western Railway as a whole necessarily devote considerable attention to the locomotives, both broad and narrow-gauge. Where new engines are to take the names of old ones, obviously the latter must either lose their nameplates altogether, as has occurred in the case of a number of them, or be renamed.

[Reply to "CHEESEWRING."]

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Record Run, G.W.R.

The particulars of the record run of the 1.30 p.m. Paddington–Worcester express, given in outline on page 249 of the March number, were based upon information made public by the Great Western Railway. Obviously, the log is not prepared on the lines adopted by Mr. Allen, so that certain anomalies, such as those you suggest, due presumably to general noting of the times only, are quite probable. The particulars are, in fact, mainly of interest in regard to the overall performance. Other matters covered in your letter will be dealt with by Mr. Allen.

[Reply to E. LITTLE.]

Irish Railway Locomotives.

Statistical particulars of Irish railways are included in each edition of the RAILWAY YEAR BOOK. That for 1923 is, however, now out of print, though the 1924 edition will be published shortly. The Great Southern and Western Railway has 16 4-6-0 locomotives. Of these, we believe, 11 constitute the goods class. 4-4-0 locomotives are able to deal with the heaviest duties on the Great Northern line, though engineering considerations, notably those involved by the Boyne Viaduct, near Drogheda, have probably a limiting influence against the use of larger engines.

[Reply to R. E. HEBDITCH.]

L.N.E.R. "Pacific" Train Loadings.

The 5.45 p.m. down Leeds, &c., express takes a regular nightly load of 12 eight-wheeled corridor coaches and 3 twelve-wheeled dining-cars, and we have known this made up at times of exceptional pressure by two further eight-wheelers to a total of 74 axles, or about 550 tare tons. We have no precise information as to the maximum load taken by one of these engines in ordinary service, although the train taken by No. 1471 on the experimental run to Grantham consisted of twenty corridor vehicles, and weighed 620 tons.

[Reply to J. E. SHAW.]

Italian Thermo-Aero Locomotive.

The cutting enclosed by you had already come under our notice. The idea of using compressed air and steam in combination is by no means new. In fact, some twenty years ago, a North British locomotive was experimentally fitted on these lines. There may possibly be something in the scheme as now suggested, but, obviously, it cannot produce economies anything like on the scale suggested. Apparently, indeed, it has yet to be tried out, and probably, as in the case of so many of these attractive propositions, an old engine will be fitted up and little more will be heard.

[Reply to R. N. MICKLEWOOD.]

Southern (S.E. & C.) Locomotives.

We have no information as to whether the remaining D and E class 4-4-0 engines will be rebuilt to correspond with those already reconstructed. In view of the successful results given by the latter, it is quite probable that others will be similarly dealt with in due course. Engineering improvements already permit the big locomotives working on to portions of the Chatham division where they were formerly barred. No information is, however, available as to when it will be practicable to work the bigger classes into Victoria.

[Reply to J. G. S.]

Superheated Engines, L.M.S. (Midland Division).

The easiest method of distinction is by noting whether or not the mechanical lubricator, which has been applied to all the superheated engines on this division, is carried; it is located in the customary position ahead of the driving splasher. The Class 3 and Class 4 superheated engines are further distinguished by substantially extended smokeboxes, and the Class 2 superheated 4-4-0 engines are easily detected by the raised running-plate over the driving wheels.

[Reply to G. H.]

Locomotive Chimneys.

No doubt, the "stovepipe" type of chimney now adopted for London and South Western section locomotives has been decided upon for good and sufficient reasons, probably because of reduced cost of construction and suitability in other respects. It does not follow that because this type of chimney does not meet with your approval it may not meet with the appreciation of others. In any case, the matter is rather one of construction than of regard for appearances.

[Reply to W. TAYLOR.]

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Midland (L.M.S.) Railway Compound Locomotives.

We agree that the Mackay photograph mentioned by you conveys at first glance the impression that the engine is a 4-6-0. Examination shows, however, that this is purely a matter of reflection and light and shade. What appears to be the splasher to the middle of three coupled wheels is actually the parallel curve of the splasher of the rear pair of coupled wheels. Various statements are current as to the other matter you mention, but we have as yet no definite information.

[Reply to "CAERPHILLY CASTLE."]

Banking Engines.

In the case of trains which are banked in rear up heavy gradients, the driver of the train engine is able to communicate with the driver of the banker, by means of his whistle, in the event of a signal at danger, or other obstruction. In any case, the speed of a banked train is never high, and the driver of the banker has ample opportunity of noting the probability of a home signal at danger by first seeing the distant signal at danger also as he passes it.

[Reply to A. O. BARKWAY.]

Engine Sheds, L.M.S.R.

For particulars, as far as available, see RAILWAY YEAR BOOK. The 1923 edition is, however, out of print. That for 1924 will be published in April. You are correct in pointing out that the Midland 990 class includes only engines 990-999. Particulars of locomotive renumbering supplied to us and summarised in the February issue allotted, however, the numbers 900-999 for this series and other engines which may be added or which will be classed with them. [Reply to W. F. STEVENS.]

Four-cylinder Engines.

We do not know exactly what you mean by the pistons of four-cylinder engines working "in pairs." It is customary to arrange the four cranks at 90 degrees to each other, equally dividing up the circle, the only exception we know to this practice being an experimental 0-6-0 tank engine designed by Mr. J. A. Hookham for the late North Staffordshire Railway. The slide-valves or piston-valves are usually arranged to work in pairs off two sets of valve-gear.

[Reply to A. G. B.]

Heating Surface.

There is no absolutely universal practice in this country as to whether heating surface should be measured on the inside or the outside of the tubes, though we believe that you are correct in stating that the most customary method of measurement here is to take the outer surface of fire-tubes and the inner surface of superheating tubes—*i.e.*, the surfaces actually in contact with the water and steam respectively.

[Reply to J. S. COLMAN.]

G.E. Locomotives on G.N. Section.

Several of the new series of "1000" class 0-6-2 tank engines recently constructed at Stratford are being worked on Great Northern suburban services for comparative trial purposes. To permit of this, although fitted with the Westinghouse brake, the engines have been equipped for vacuum-brake control of the trains. Others of the class, Nos. 990-999, are at work on the Great Eastern section, together with the "1000" series.

[Reply to STANLEY H. BURNS.]

Southern (L.B.S.C.R.) Railway Locomotives.

Seeing that Mr. W. G. Tilling's book, "The Locomotives of the L.B. & S.C.R.," is of recent preparation, whereas the Locomotive Publishing Company's booklet, "The Locomotives of the L.B. & S.C.R., 1830-1903," was published a number of years ago and does not cover up-to-date developments, it would seem that Mr. Tilling's statements as to the classification of engines are more likely to be in accordance with present-day conditions.

[Reply to "BRIGHTON."]

L.M.S. Power Classification.

This power classification is based on definite considerations of average running speed, tractive effort and steam production, as we explained, and is obviously very approximate, seeing that five classes cover the whole of the locomotive stock. It is not intended as a *type* classification, but as a rough *power* classification, which is a different thing altogether.

Your second query is not clear.

[Reply to C. H. SIMMONS.]

Stratford Widenings, L.N.E.R.

Widenings on the down side of the main line between Bow Junction and Stratford

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are being made in order to provide additional empty carriage lines, so as to keep empty trains from the running lines for a further distance than is at present practicable. Additional alterations in this district are contemplated by the company's Bill now before Parliament, but no work has, of course, yet been done in regard thereto.

[Reply to R. B. B. T.]

Stratford Works, L.N.E.R.

Exaggerated stories are current as to the proposed closing down of these works. The only justification, therefore, is the fact that it is not anticipated that, in future, many, if any, new locomotives will be built there. As it is, however, the works are occupied to nearly full capacity in dealing with repair and general maintenance work, &c., so that there has always been a limit to the possible output of new locomotives.

[Reply to "NAUTICUS."]

Midland 12-wheeled Non-corridor Stock.

A number of 60-ft. 12-wheeled non-corridor coaches, with lavatory accommodation, were built by the Midland Railway for the London–Manchester service in 1898. The early dining cars on this service were not vestibuled to the trains, and this 12-wheeled stock was included in the dining-car formations. To-day these coaches are still in use, as noted by you, but on secondary services.

[Reply to F. E. M. and D. F. ANDREWS.]

Grassington Branch, L.M.S.R.

Your explanation as to working at Embsay station is probably correct. *Bradshaw* shows a train from Embsay to Ilkley apparently leaving Embsay at 7.58 a.m. All other trains from that station are shown as coming from Skipton. Possibly some of our readers familiar with train working in the district may be able to explain the connections given at Ilkley at 8.21 and 9.2 a.m.

[Reply to H. H. T.]

Stationmasters and Divisional Superintendents.

All stationmasters, whether at large or small stations, are necessarily under the divisional superintendent or corresponding divisional officer, according to the system of organisation. The stationmaster himself is, however, responsible for all staff under his control, and unless special need arises therefor the divisional superintendent does not interfere.

[Reply to "CLARAIL."]

S.E. and C. Locomotives (S.R.)

Although not in accordance with the rules, we may pass on notes from several readers to the effect that South Eastern and Chatham Railway domeless 4-4-0 No. 458 is, or was, stationed at Tonbridge, and that domeless 0-6-0 goods engine No. 387 is, or was, at Margate (West).

[Further reply to A. H. S. BRADLEY and others.]

Dousland Station, G.W.R.

Presumably, this station was given a long platform to meet special local requirements, possibly occasioned by special work in the district during the war period. So far as our recollections of the branch are concerned, this station had a short platform only. Local readers may possibly be able to supply further information.

[Reply to "SILURIAN."]

Signal Practice, L.N.E.R.

No doubt, in time, there will be a degree of uniformity in signal practice throughout the various sections and divisions, but no statement has yet been made as to whether "somersault" or ordinary signals will be standard. In fact, this is a matter which must develop gradually, and only time can show the lines which future practice will follow.

[Reply to "CLARAIL."]

Electric Rolling Stock, S.R.

As mentioned in the March number, several electric motor vans have been provided for use as components of electric stock when electrification is inaugurated on further "Brighton" routes. In general, they correspond to the motor coaches at present in use, except that they have van instead of compartment accommodation.

[Reply to G. C. BOLTON.]

Enginemen's Ordeal.

We had already seen the newspaper reference (of which you send cutting) as to two French enginemen travelling for six miles under a runaway engine. From

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the particulars given, we should imagine the facts were substantially as stated, and should hardly be prepared to class it as "something like a fairy tale."

[Reply to H. J. HARRISON.]

Great Eastern Locomotives.

Nos. 1791, 4-4-0, and 1240 (not 1140), 0-6-0, are the only engines on this section of the London and North Eastern Railway fitted with the Weir feed-pump and heater. The apparatus you have noted above the middle splashers of 4-6-0 engines Nos. 1518 and 1547 is an arrangement for cleaning the tubes by means of a steam jet.

[Reply to "WITHAM EAST."]

Foxwell's "Express Trains."

The correct title of this volume is "Express Trains, English and Foreign," the authors being E. Foxwell and T. C. Farrer. It was published, in 1889, by Smith, Elder and Co. It is, of course, long since out of print, and it is doubtful whether copies could be obtained, except through a second-hand bookseller.

[Reply to A. D. C.]

Japanese Locomotives.

No further information is available concerning the locomotives illustrated in the October, 1923, number. We agree that the engines of the class in question must rank as remarkable locomotives for the 3 ft. 6 in. gauge, though in the absence of full details the comparison suggested by you cannot be made.

[Reply to L. G.]

New L.N.E.R. Lines.

The connection referred to is, we understand, to connect the Palace Gates branch of the Great Eastern section with the Great Northern Enfield branch. These already come very close together, hence the connection is a relatively easy one, but may prove of great value in due course. [Reply to R. G. H.]

Headlights, London and North Eastern Railway.

Blue and purple lights and discs are being tested on certain routes of the Great Eastern section, for observation as compared with green, which is extensively used for head codes on both sections. Great Eastern 2-4-0 mixed traffic locomotives of the 420 class date to about 1893. [Reply to G. WHITEHOUSE.]

Swedish 4-6-2 Locomotive.

You are correct in pointing out that the Swedish locomotive, illustrated on page 212 of the March number, should have been described as 4-6-2, and not as 4-6-0. Another typographical error transposed the weights of engine and engine and tender.

[Reply to T. D. CARNWATH and F. W. JOHNSON.]

King's Cross and St. Pancras-Aberdeen Express.

In reply to criticisms as to whether the view reproduced on page 244 of the March number was correctly described, it is pointed out that, although the train has a L.N.E.R. locomotive and is partly composed of East Coast vehicles, the location near Stonehaven is on the L.M.S.R.

[Reply to W. R. CLAYTON and others.]

London-Birmingham Expresses.

Some of the two-hour trains to and from Euston load up to considerable weights, though the train you mention is one of those of a medium character. The heavier trains are, of course, run morning and evening, the midday trains varying from four bogie vehicles upwards.

[Reply to "NAUTICUS."]

Railway Posters.

No doubt some of the new L.M.S. posters will be reproduced in our pages in due course. As, however, the originals will be displayed throughout the country, it will be possible for readers to see them for themselves, so far as the colour effects are concerned.

[Reply to R. N. MICKLEWOOD.]

L.N.E.R. Rolling Stock.

The suffix "Y," indicating "York," is used to distinguish rolling stock attached to the North Eastern Section. It was mentioned in the March number that some of the L.N.E.R. locomotives were being re-numbered, including Great Northern 0-6-2 tank engines.

[Reply to "L.N.E.R."]

Indicator Shelters on Locomotives.

Presumably, the erection you noted around a Southern Railway 4-6-0 locomotive on the South Western section was an indicator shelter, as fitted when indicator and other tests are being made.

[Reply to E. A. LEVY.]

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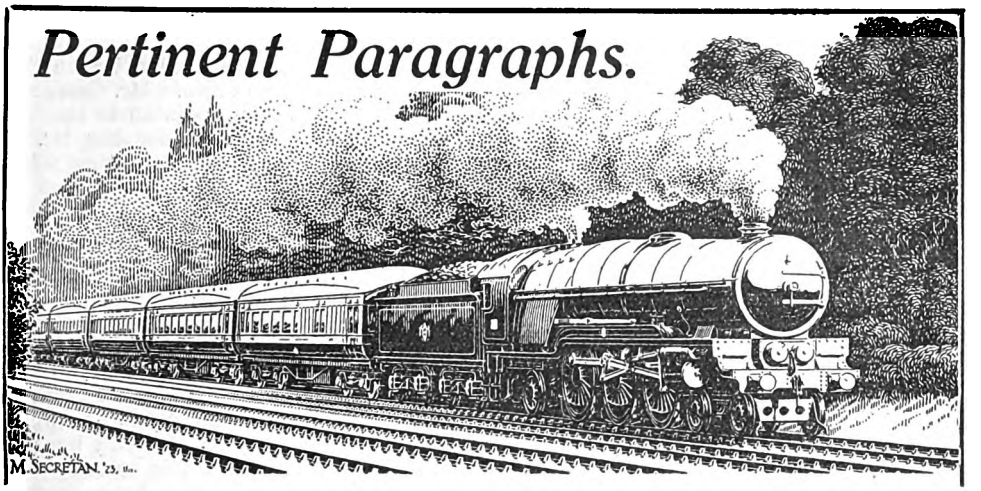
Pertinent Paragraphs.



First Meetings of the New Companies.

DURING February and March the first annual general meetings of the four new companies were held. Usually these attract large audiences, and many important topics received attention in the speeches by the respective chairmen, in regard to the working results of last year, progress of reorganisation, works in hand and contemplated, and special features such as the recent railway and dock strikes. As the directorates hitherto in office were appointed in accordance with the provisions of the Railways Act of 1921, it was necessary to elect all the directors anew by the shareholders, but, except for certain changes—notably, in regard to the London Midland and Scottish Railway, as referred to later—due to causes not peculiar to the occasion, practically all the existing directorates were confirmed. Brief reference is made to some of the matters dealt with in this and following paragraphs. As the L.N.E.R. meeting was held just as we closed for press, it receives attention at the end of Pertinent Paragraphs.

At the Great Western meeting appreciative reference was made by Lord Churchill to the knighthood conferred upon the General Manager, Sir Felix J. C. Pole. After referring to the acquisition of the Swansea Harbour undertaking, Lord Churchill discussed some of the special problems associated with railway charges and the operation of mineral and merchandise traffic, with particular relation to the mineral traffic in South Wales. He anticipated, however, from the numerous improvements in hand or contemplated in connection with the docks and railways in South Wales, that the situation would be vastly improved, particularly if proper advantage should be taken by the companies of a reduction of rates in respect of coal conveyed in fully loaded 20-ton wagons.

New Works at Southampton and New Southern Railway Steamers.

AT the Southern Railway meeting, Sir Hugh Drummond's remarks in regard to electrification progress provided principal interest. This is referred to in a later paragraph. He also gave valuable information in regard to improvements at Southampton, and the floating dock which is being built for use there.

As it was necessary to provide accommodation for the largest passenger liners in service, and the construction of a dry dock of the required size could not be undertaken in sufficient time, there was no alternative but to provide a floating dock. It is expected that by the end of April there will be installed at Southampton the largest floating dock in the world, capable of lifting 60,000 tons d.w. This dock is being built at Newcastle by Armstrong, Whitworth and Co.

Orders have been given for the construction of five additional steamers: two passenger vessels for the service between Southampton and St. Malo or the Channel Islands—these boats will be larger than any existing on these routes, and will be notable for the amount of sleeping accommodation installed and will be equipped for burning oil fuel—two cargo boats for the service between Dover or Folkestone and France, and one paddle steamer for use between Portsmouth and the Isle of Wight. Various new works are in hand, and a commencement has been made with the construction of the Totton, Hythe, and Fawley Light Railway, on the west side of Southampton Water.

Electrification Progress on the Southern Railway.

ON this subject, Sir Hugh Drummond remarked that: "Your directors are entirely in accord with the decision come to by members of the old South Eastern

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and Chatham Managing Committee to go ahead with the electrification of the whole of the South Eastern and Chatham suburban area. The Brighton Company were, at the time of amalgamation, in process of extending their electrification to a point just outside Sutton. It has since been decided to carry it through to Sutton during the present year, and we shall in due course consider the advisability of going on to Epsom. On the South Western section we have decided to extend the electrification area from Surbiton to Guildford via the Cobham line, and from Raynes Park to Effingham Junction via Leatherhead, and from Leatherhead to Dorking.

"When these schemes are carried through—as I hope they will be by the end of next year—the Southern Railway Company will have electrified nearly the whole of its suburban area, and will have an electrified route mileage greater than that possessed by all the other railways in the kingdom put together. The public will also benefit by the better services we shall be able to provide as compared with the existing steam services. On the South Western section the number of passengers carried in the electrified area has increased from 23,000,000 in 1915 to 49,000,000 in 1923. On the Brighton system the number of passengers carried last year, as compared with the year before electrification, shows an increase of 95 per cent., and we have no reason to assume that equally good results will not be shown by the proposed electrification of the South Eastern and Chatham section."

Metropolitan Railway Progress.

DURING 1923 two new stations were opened—one at Northwick Park, near Harrow, and the other at Hillingdon, near Uxbridge. Referring to the reduction in passenger fares during the year, Lord Aberconway pointed out, at the annual meeting, that the percentage of falling-off in receipts was considerably less than the percentage of reduction in the fares; that is to say, that the percentage ratios were brought about, not by an increased number of passengers carried, but by the growth in our longer-distance business, thus confirming the policy adopted in recent years of encouraging traffic to and from the outlying suburbs in the north-west by assisting in the development of building estates in the districts beyond Harrow. In this connection reference was made to the development section of the Commercial Manager's department, under Mr. John Wardle.

Mention was also made of changes affecting the shops and works at Neasden. Hitherto the whole of the electrical, locomotive, and carriage and wagon work has been under the supervision of one office. Mr. George Hally has therefore been appointed to take charge of the mechanical side, leaving Mr. Jones to devote his time to the electrical side.

Facilities for the British Empire Exhibition.

REFERENCE was made to the rebuilding of the older stations, notably Farringdon and High Holborn; also improvements at Baker Street and elsewhere. Willesden Green and St. John's Wood stations are to be reconstructed. In regard to the British Empire Exhibition, Lord Aberconway remarked: "Those who travel down the line will have seen the preparations that we have made for dealing with the traffic to and from the Exhibition. . . . We have spent over £50,000 in improving and enlarging the accommodation at Wembley Park station, so that we may say that everything possible has been done to attract the Wembley traffic to the Metropolitan Railway. We can bring people from Baker Street right into the Exhibition grounds within about 11 minutes. Our arrangements with regard to the Football Cup Tie last April were tested, and although there was a great deal of complaint about the organisation of the Stadium, our traffic was carried in a way that was quite admirable. . . . Mr. Holt and our traffic officers, whose arrangements on that occasion deserve the highest praise, tell me that they can now cope with all the traffic which we expect to get from the Exhibition and from the Cup Tie. From the new platforms and booking hall there is a covered way direct into the Exhibition grounds. The Exhibition authorities are constructing what is known as a 'never-stop' railway round the Exhibition grounds; that will be connected with the booking hall of our station and will be a valuable feeder to our line."

The "Underground" and London Traffic Control.

THE associated "Underground" railways now operate 68, the tramways 114, and the omnibuses 753 route miles. They own 127 railway stations, 40 omnibus garages, 33 depots, repair shops and works, 6 power stations, 46 sub-stations, 1,673 railway cars, 587 tramway cars, and 4,496 motor omnibuses, while employees number 42,000. During 1923, 1,798 millions of passengers were carried, of which no fewer than 1,214 millions were conveyed by the omnibuses. Notwithstanding the progress made, however, all the railways record decreases both in total numbers of passengers and in receipts, although the omnibus facilities improved in both respects.

Commenting upon the proposals for

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London traffic control, Lord Ashfield pointed out, in his addresses at the recent annual meetings, that the traffic problem is not confined to omnibuses. "It embraces railways and tramways, and because of their diversity of capacity and function becomes complex. If railways and tramways constructed under statutory authority are to be subject to unrestricted omnibus competition, then a policy of expansion is at once impossible and the maintenance of existing railway and tramway services exceedingly doubtful."

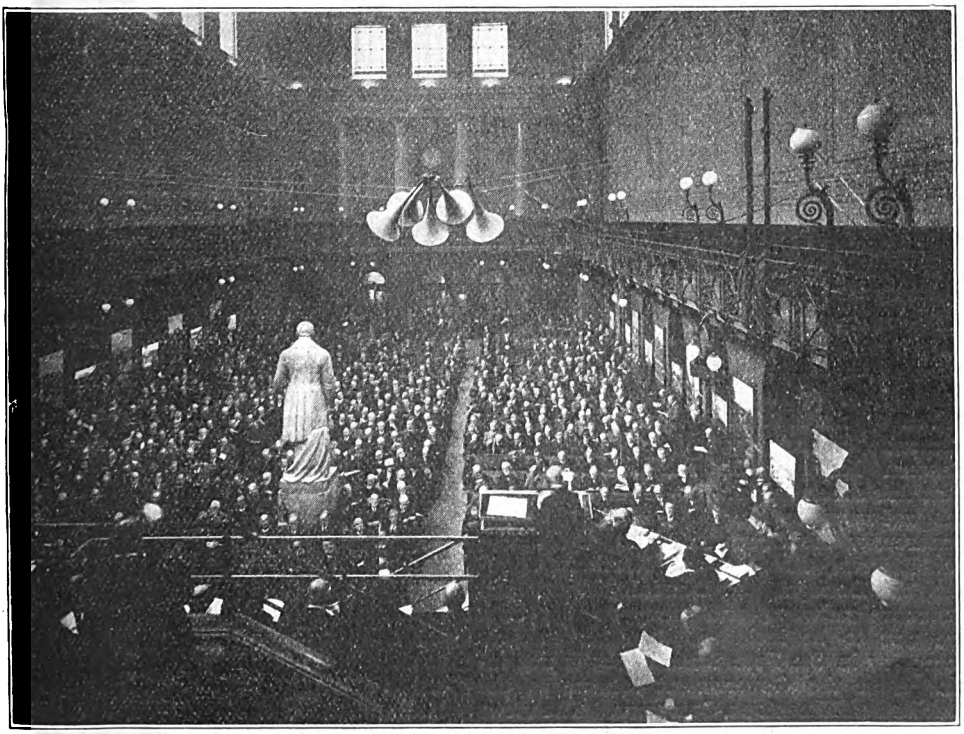
L.M.S. Railway Meeting.

THIS meeting, held on February 29, was notable in several respects. Firstly, it was held in the Great Hall of Euston Station, which, for the first time, was converted into a general meeting room, wireless amplifiers being effectively utilised so that every word spoken could be heard clearly. The hall was temporarily cleared of the exhibits usually located there, and seats provided. Incidentally, around the walls, the originals of pictures painted by Royal Academicians and other artists, from which the new L.M.S. posters are to be prepared, were exhibited.

The second point of special moment was the announcement of changes affecting both the directorate and the chief officers of the company. Lord Lawrence of Kingsgate, who had the honour of presiding at the first annual general meeting of the London Midland and Scottish Railway Company, announced his own retirement from the chairmanship, though he will retain his seat on the directorate. It is worthy of note that Lord Lawrence has been a director continuously from the time when he first joined the London and North Western Board 40 years ago. As noted elsewhere, Sir Guy Granet has been elected chairman in succession to Lord Lawrence, while Mr. George Macpherson shares with Mr. Edward Brocklehurst Fielden the responsibilities of the deputy chairmanship. On the official side the outstanding changes are the retirement of Sir Arthur Watson, to whose services during the difficult period of amalgamation Lord Lawrence made appreciative reference, and the appointment of Mr. H. G. Burgess, who became Deputy General Manager last December, to succeed Sir Arthur Watson.

Irish Railway Meetings.

A NUMBER of pertinent points were brought out in the speeches at the annual



L.M.S.R. FIRST ANNUAL MEETING HELD IN EUSTON GREAT HALL.

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meetings of the respective Irish railway companies. At the meeting of the Dublin and South Eastern Railway, Sir Thomas Esmonde, Bart., explained that the damage to property arising out of recent political disturbances involved a sum of £84,106, as referred to on page 335. Referring to the public impression that railway fares stand to-day at the same rate as they were increased to during the war, he explained that, so far as this company was concerned that was a complete misapprehension, for their fares as a whole had undergone at least two revisions since the cessation of British State control. First, the fares all over the line were reduced at the time of the abolition of second-class accommodation. Second, on April 1, 1922, the fares in operation over the whole of the suburban service were revised, and in this revision they were brought down to near pre-war level. The disturbance in the country affected goods traffic more adversely than it did the passenger traffic. During the year, 15 locomotives were extensively repaired at Grand Canal Street Works and other work carried on, while the Great Northern Railway assisted by repairing two of the Dublin suburban tank engines, work which could not be done at Grand Canal Street as the men there were working full time repairing engines maliciously damaged.

At the Cork, Bandon and South Coast Railway meeting, the chairman, Mr. Theodore F. Carroll, explained that, owing to the firmness and courage of the Government, they were able gradually to repair the destroyed bridges, and on February 20, 1923, they started a service of trains between Cork and Bandon. On March 5 of that year it was extended to Clonakilty, and on the following day to Drimoleague.

Railway Grouping in Ireland.

PROPOSALS for the grouping of Irish railways received attention at the meetings of most of the railway companies. One proposal is for the unification of all the Irish railways, north and south. Sir Thomas Esmonde, chairman of the Dublin and South Eastern Railway Company, pointed out that this scheme would not embrace even all the railways in the Free State, because apparently the Great Northern, the Cavan and Leitrim, the Sligo and Northern Counties, the Donegal, and Dundalk, Newry and Greenore railways, and many smaller lines are not to be included. Another railway company in the Free State which is not included in the Government scheme is the Dublin and Kingstown Company. The views of the chairman and general managers of the companies in November, 1922, were, however, as expressed in the following minute :—

> " The companies are confirmed in their opinion that the formation of two groups is preferable to unification, and that the best division is, roughly, north and south of a line drawn between Dublin and Galway."

An alternative grouping scheme was suggested by Sir Thomas Esmonde, who expressed the opinion that the grouping which would give the most beneficial results to the country as a whole and consequently to the railways themselves, would be the grouping of the main lines running west and east into one group, and the lines running continuously north and south into a second group:—

Group 1.—Great Southern and Western, Midland Great Western, and the smaller lines running south and west of them, with certain running powers over Group 2.

Group 2.—Great Northern, Dublin and South Eastern, and the lines that lie naturally along the north-south route, with certain running powers over Group 1.

Result of a Signalling Mistake.

AT about 5.3 p.m. on January 9, the 3.21 p.m. train from Nottingham to Liverpool, worked by Midland Division locomotive No. 501, came into collision with four coaches, without engine, standing at a platform at Crewe station, ready to form the 5.10 p.m. train from Crewe to Liverpool. Thirteen passengers, ten in one train and three in the other, complained of shock or received slight injuries, while the pilot driver on the Midland engine and the guard of the Nottingham train were also injured. In no case, however, were the injuries serious, though the locomotive and several vehicles were somewhat badly damaged.

Signalling at Crewe is all-electric, controlled from power frames. The accident was due to a mistake on the part of a signalman at Crewe South Junction box. This mistake was candidly admitted, and the signalman accepted full responsibility for the accident. As Major Hall points out in reporting upon the accident, his action in pulling the wrong signal was clearly quite inadvertent and in no way due to forgetfulness of the presence of the coaches on the platform road. " In a busy box such as this is, and with movements following one another in quick succession, occasional mistakes of the kind are not unnatural, and it is to the credit of signalmen generally that they are relatively very infrequent." Major Hall makes the suggestion that the situation is one which would have been protected had the station been track-circuited. He

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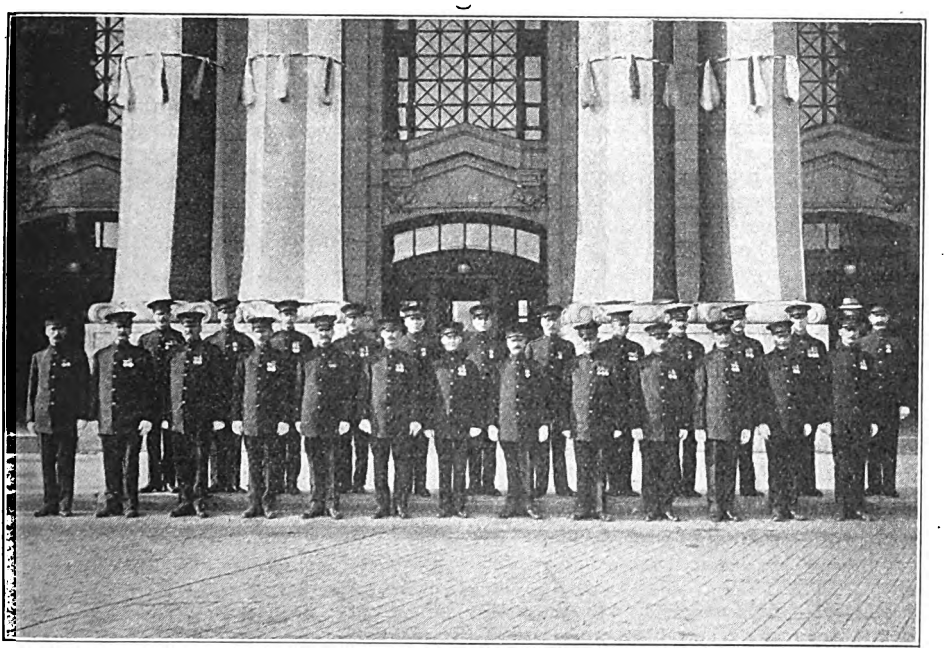

A BODY OF C.P.R. POLICE AT WINNIPEG.

expresses the opinion that Crewe station is certainly a locality where its installation is desirable, but adds that the company is in agreement with this view and that a scheme for the installation of track circuiting at Crewe is now in hand.

Canadian Pacific Railway Police.

THE recent death of Mr. R. G. Chamberlin, Chief of the Department of Investigation of the Canadian Pacific Railway, draws attention to a phase of the company's activities which is little known beyond the confines of the Dominion, and to the novel railway and police body which he created and brought to such a high state of efficiency.

During his career Mr. Chamberlin had participated in events which served to display his thorough methods. When in 1901 the Duke and Duchess of York, the present King and Queen, travelled through Canada, Mr. Chamberlin was in charge of the arrangements made for guarding the Royal party. When Prince Arthur of Connaught travelled across the Dominion on the way to Japan to present certain honours to the Ruling House, Mr. Chamberlin was again in charge of the arrangements. When in 1920 the Prince of Wales paid his official visit to Canada, Mr. Chamberlin was responsible for the safety of the party; also in September last, when the Prince came incognito on his holiday tour as Lord Renfrew. At one time Mr. Chamberlin was President of the Chief Constables' Association of Canada.

The Canadian Pacific Railway Police are carefully selected for character, appearance and physique. This is the foundation which has made the body of such value both to the company and to the Dominion. Most of them on joining are equipped with a certain amount of previous experience, which a careful and thorough expert training develops to a high expertness in the various phases of police duty. Their duties are many and varied and call for play of the widest scope of intelligence and ability. Primarily their duty is to protect the interests of the company, to guard stations, the right-of-ways, prevent theft, as well as to safeguard the passages of royalty and other notable personages travelling across the Continent, and to facilitate the travelling of railway clients generally.

Their presence in Canada ably augments Federal and Provincial bodies, and is an invaluable aid to the preservation of good order throughout the country. In every locality where Canadian Pacific activities centre, their appearance and physique make them at once conspicuous and adds in no little measure to those outward signs which enhance the prestige of the Canadian Pacific Railway Company. When the Great War broke out in 1914 it was found necessary to increase the force in order to protect bridges, elevators round houses and other buildings,

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and over 800 men were added for this purpose.

Jubilee of a Famous Locomotive Class.

MR. J. N. MASKELYNE'S article under this title in the March number had caused several readers to write in regard to matters of interest suggested thereby. Mr. S. Wallace points out that high-sided tanks fitted to No. 248 were added early in 1920, after this engine had been involved in an accident at Streatham Common in the latter part of 1919, and not by Mr. Marsh, as stated. In regard to the Clapham Junction and Addison Road service, for which these engines have been almost exclusively employed for a long period, Mr. Wallace states that No. 4, *Mickleham*, was engaged on this duty for some years until it was broken up. No. 222 worked this service more recently and retained the spring-balanced safety valves and copper-capped chimney to the last. He points out that this service was, at the time of writing, worked by No. 281, which has been specially fitted for vacuum brake control to enable a set of London and South Western vehicles to be employed.

Train-Working Curiosities.

WRITING from Rugby, Mr. C. R. Clinker sends some notes as to unusual train workings, which, as they appear to include features of general interest, may be briefly referred to. Dealing first with two non-stop runs which occasionally take place, Mr. Clinker points out that when the 10.55 a.m. Plymouth to Birmingham train was divided in the latter part of last year, the first part ran non-stop from Exeter to Cheltenham (Malvern Road), via the Bristol avoiding lines. A special excursion train was also run recently from Walsall to Cheltenham via the Birmingham loop line. Another run performed at intervals during last summer was from Plymouth (North Road) to Cheltenham, calling for two minutes at St. Philip's Marsh (Bristol) to change engines.

A somewhat curious working of a different character is that of the 10.15 p.m. summer train from Portishead to Bristol, which is given an unusually lengthy time between Bedminster and Temple Meads. The explanation is that this train runs via the relief lines and enters Temple Meads from the London end, so that it can be brought into the old station to form the 11.5 p.m. to Clifton Down. Other instances of unusual workings mentioned by Mr. Clinker are the 7 a.m. from Loughborough (Derby Road), via Nuneaton, to Rugby as a through train. These vehicles return at 7.5 p.m. from Rugby and work through to Burton-on-Trent. He also mentions the 8 a.m. from Leamington Spa to Liverpool, via Birmingham, the 8.10 a.m. from Napton and Stockton to Birmingham, via Berkswell, and the 6.35 a.m. from Coventry to Northampton, via Daventry. The two former of these are the only ordinary down passenger trains using the loop line between Kenilworth Junction and Berkswell.

4-6-2 Locomotive, Swedish State Railways.

REFERRING to an illustration of this class given on page 212 of the March number, Mr. H. A. Berggren sends some further remarks in regard to this type, as follows:—

"The first engine of this type was built at the well-known works of Nydquist & Holm, of Trollhättan, Sweden, early in 1914, and shown at the Baltic Exhibition at Malmö that year. Altogether, 11 such locomotives were built, the first 10 being numbered 1200-1209, and the 11th, I believe, 1286. No. 1200 has been a peculiarly 'unlucky' engine. At the trial run it ran into the rear of a goods train and caused considerable damage. At least on two other occasions it has been in serious accidents, once in the terrible accident at Geta, when the continental express fell into a cavity caused by the subsidence of a high bank; the engine, however, was recovered. It became nearly submerged in a lake, but is now running as usual.

"Although the average speeds of the continental expresses are seemingly low, very fast work is done in 'making up' time, when connections are late. Sometimes over one hour is made up in a trip of about 11 hours. The maximum official speed is 57 m.p.h., and long stretches are run at this speed, and, 'unofficially,' speeds up to 75 m.p.h. are now and then attained on favourable portions of the line. During the winter, when heavy snowfall and severe blizzards often occur, these engines manage to keep time in a remarkable manner.

"I suppose you have noticed the unusual build of the tender, being semi-circular, with the coalbox as a saddle."

Football Specials on the Great Northern Railway (Ireland).

ON the occasion of the International Rugby Match between England and Ireland, played on the new I.R. Union ground at Ravenhill, Belfast, on February 9, the Great Northern Railway of Ireland ran several special expresses. It is estimated that about 1,800 football enthusiasts were carried from Dublin alone. The specials were booked to leave Amiens Street, Dublin, at 10.15, 10.30 and 10.45 a.m., and were scheduled to run non-stop to Portadown (87½ miles) in 100 minutes and to pass Drogheda (31¾ miles) and Dundalk (54½

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miles) in 35 and 60 minutes respectively. After a short stop at Portadown for Customs examination, 27 minutes only were allowed for the 25 miles' run into Belfast, the overall time for the 112½ miles from Amiens Street being 2 hours 10 minutes. The first two trains, each consisting of 8 bogie coaches (averaging 30 tons empty), were hauled by 4-4-0 superheater locomotives Nos. 171 and 172 respectively, and despite slight Customs delays at Portadown kept very close to their schedule, No. 1's net time to Belfast being given as 2 hours 4 minutes.

The third Special, in which our correspondent (Mr. H. W. Lea) travelled, "did not get away until 10.55 a.m., two extra coaches having to be added at the last moment, making a load of about 300 tons empty, with the result that engine No. 174 found the task of keeping to schedule beyond her powers, which is not surprising having regard to the gradients to be coped with, details of which will be found in the RAILWAY MAGAZINE for September, 1919. Considering everything, however, her driver did not do badly in passing Drogheda (31¾ miles) in 41 minutes, and reaching Dundalk (54½ miles) in 67 minutes, where a special stop was made to obtain assistance in the shape of a small 4-4-0 No. 75. The performance of the two engines from Dundalk to Belfast was somewhat disappointing, the 33 miles to Portadown occupying 43 minutes, and the 25 miles from Portadown to Belfast 32 minutes. Allowing for the load, gradients and adverse weather conditions, the latter being about the worse possible, the net time of 2 hours 22 minutes from Amiens Street to Belfast was by no means discreditable.

Return Working.

"FOR the return journey," continued Mr. Lea, "the company had arranged for three Dublin Specials to leave Belfast at 6.45, 7.10 and 7.25 p.m., but so many had travelled up for the match by ordinary trains that morning and the evening before (the 9.15 a.m. from Amiens Street being especially heavy) that it was found necessary to run a fourth Special back. From Belfast the return Specials were booked non-stop to Dundalk (58¼ miles) in 68 minutes, and to cover the 54½ miles from Dundalk to Amiens Street in 62 minutes, or 2 hours 10 minutes net from Belfast." The 6.45 p.m., on which our correspondent returned, was hauled by No. 171 (*Slieve Gullion*), and with a load of about 250 tons passed Portadown (25 miles) in 30 minutes, stopping at Dundalk in 69 minutes 30 seconds. "Leaving Dundalk at 7.59 p.m., the 1½ minutes lost to Dundalk would have been regained, but unfortunately, after passing Howth Junction ominous whistling by No. 171 betokened adverse signals (the offender being a Howth local), and she finally crawled to a stop at Raheny, the 50½ miles from Dundalk having been covered in 55 minutes to the dead stop, and the 28 miles from passing Drogheda in even time. But for this mischance, Amiens Street would probably have been reached within the hour from Dundalk. The other return Specials were more fortunate, and are stated to have run approximately to time."

In conclusion, Mr. Lea points out "that the increased overall times now shown in the time-tables for the Dublin-Belfast express trains are not due to any falling off in the locomotive work in the Great Northern Railway, but are due to the vexatious delays caused by the Customs examinations which, in the case of trains entering Northern Ireland from the South, are now carried out at Goraghwood, while the Free State examination in the opposite direction is conducted at Dundalk."

"Sentinel-Cammell" Steam Rail Coach in Jersey.

IN the May, 1923, number, in the course of Mr. H. L. Hopwood's article on the "Railways of Jersey," reference was made to the contemplated introduction of a steam rail car by the Jersey Railways and Tramways Company. The car has since rendered splendid service, and a service is also now in use, both of the "Sentinel-Cammell" type introduced by Cammell Laird & Co. Ltd., and the "Sentinel" Wagon Works (1920) Ltd.

Recently, demonstrations took place over the whole length of the Jersey Railway and Tramway Company's system, which extends for 7¾ miles from St. Helier round St. Aubin's Bay to St. Aubin's and thence to Corbière. In the morning No. 2 rail motor coach in ordinary service was utilised for a run to Corbière, and in the afternoon the same vehicle was run specially from St. Helier to Corbière non-stop, and back with one stop at St. Aubin's. Those present were very much impressed with the performance of the car, especially on the hill section between St. Aubin's and Corbière. Braking tests were satisfactorily carried out, and appreciative remarks were made on the ability of the coach to accelerate quickly. The vehicle ran very smoothly, and fully demonstrated its fitness to merit the most careful consideration where vehicles were required to meet certain difficult conditions.

The traffic on the Jersey railways and tramways varies greatly between the two sections. On the St. Aubin's Bay section some 64,000 passengers are carried monthly, while on the St. Aubin's–Corbière section

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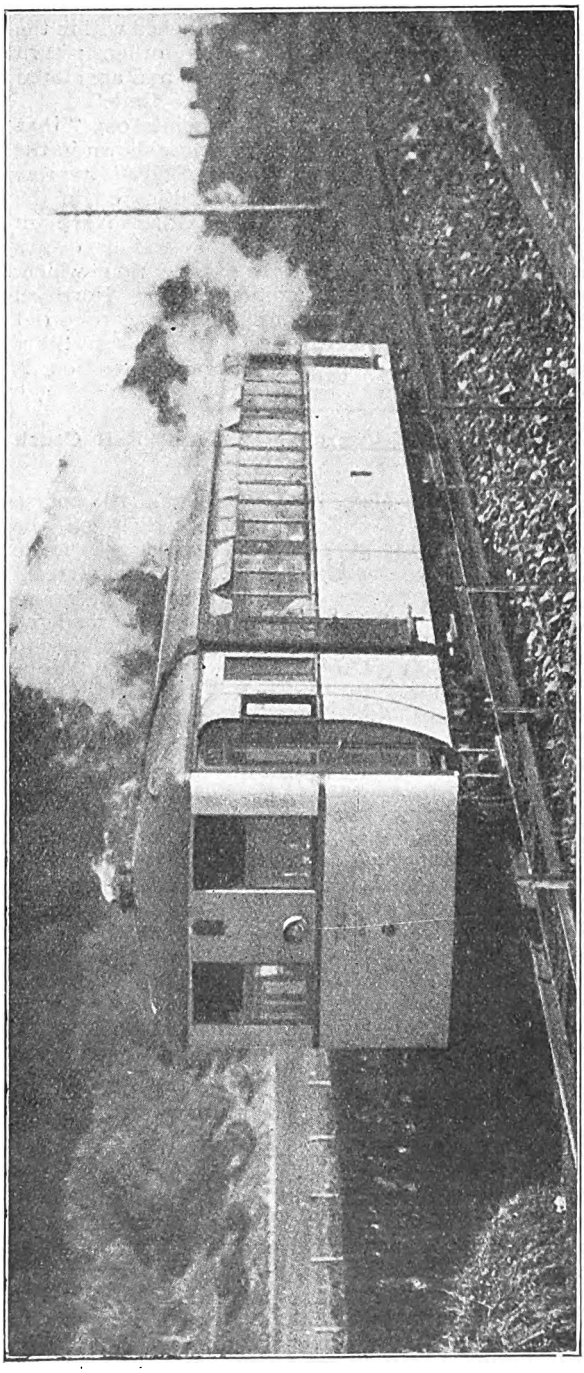
the passenger traffic is purely nominal except during the summer. On the St. Aubin's Bay section the track is practically level throughout with easy curves, while on the St. Aubin's–Corbière section the grades and curves are severe and continuous.

Between the hours of 8.30 a.m. and 11.15 p.m. a half-hourly service of trains is maintained between St. Helier and St. Aubin's daily. The line is single-track throughout, with a crossing station on the St. Aubin's Bay section at Millbrook, halfway between the termini, and at Don Bridge, on the hill section, situated practically halfway between St. Aubin's and Corbière stations.



"SENTINEL-CAMMELL" STEAM RAIL COACH IN SERVICE ON ST. AUBIN'S SECTION, JERSEY RAILWAYS.

Working Results.

THE timing of trains is arranged so that they shall meet punctually at the crossing stations, and this has an important bearing upon the working of the rail motor coaches. Prior to the introduction of these vehicles in June, 1923, the service was worked by three sets of locomotive-hauled trains each weighing (with the engine and brake van) 56 tons gross and seating 144 passengers, giving a weight per unit of seating capacity of 0·39 ton. With the introduction of the "Sentinel-Cammell" rail coaches, weighing an average of 16 tons and carrying 56 passengers each, only one ordinary train remains in service. The savings that have been effected since the introduction of the steam rail coaches will be appreciated from the following details. Rail coach No. 1, which weighs in working order 15·15 tons, runs 683 miles weekly, and during its eight months' service has completed 23,000 miles, and it has replaced a train of four ordinary coaches, weighing with engine 56 tons. The comparative ton-mileage figures are, therefore, 1,334,000 for the ordinary train and 391,000 for the rail coach, the difference of 943,000 ton-miles representing a saving of 71 per cent. in favour of the steam rail coach.

The reduction in coal consumption has also been satisfactory. Each of the locomotives working the service prior to the introduction of the rail coach was supplied daily with an issue of 1·05 tons of coal,

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whereas the rail coach has an issue as low as 0·294 ton per day. The eight months' coal consumption of the rail coach is, therefore, 71·5 tons against the 255·5 tons of the locomotive, a saving of 184 tons or 72 per cent. The reduction in coal consumption for equal service represents a saving of approximately £600 per annum, a matter of importance to a small company. Incidental savings are also effected in the reduction of interest on coal stored, reduced wear and tear of track, and other economies, which have made it possible for the management to maintain a half-hourly service. It is stated also that the efficiency of the railway service now given is such that it has successfully met the competition of road transport in the district served.

Railway Carriage Lighting.

TRAIN lighting is one of the most important ancillaries of rail transport, and it can safely be stated that the comfort of a tube journey at all times, or a night journey by other trains, depends upon efficient lighting of the car or coach. Older readers of the RAILWAY MAGAZINE will remember when lighting by evil-smelling oil lamps, which only made the darkness more visible, was almost universal. A feature of the stock-in-trade of railway bookstalls was a candle reading lamp which could be affixed to the glass quarter-light by suction by means of a hollow rubber cushion. These were sold to travellers who wished to read on night journeys. Coal gas was introduced as a luminant on some trains, particularly those running on tunnel sections in the Metropolis. This was a considerable improvement on the oil lamps, although improvements were made in oil lighting. The late Great Northern Railway had a type of lamp which it was sought to improve by painting a white band, about 1 in. deep, around the globe. This band was in the nature of a reflector, and as a consequence these railway carriage lamps were nicknamed "stamp margin lamps." Electric lighting made its appearance on a few trains of the London, Brighton and South Coast Railway some forty years ago and was slowly adopted tentatively by a few other railways. The first railway carriage lighting to approach satisfaction resulted from the use of compressed oil gas. Most of the railways spent large sums on erecting plants to manufacture the luminant.

Electric Train Lighting.

MEANWHILE improvements in electric lighting apparatus caused electricity to be used on a somewhat extensive scale. The London and North Western Railway, some twenty or so years ago, decided to adopt the electric light almost exclusively, although it was said it had over half a million sunk in gas-lighting plant. Improvements in incandescent gas mantles, and the invention of the inverted type, gave oil gas a renewed life, and it is still largely employed in railway carriage lighting. The introduction of electric trains has further increased the use of electric light, as for such trains current is always available, A paper recently read by Messrs. J. F. Caine and E. A. Marx, jnr., before the Society of Illuminating Engineers, deals with the electric lighting of railway cars and coaches. In this paper it is pointed out that low-voltage lamps are more efficient than those of higher pressure, a 110-volt 60-watt lamp yielding 700 lumens against 570 lumens from a similar lamp with 250 volts. A disadvantage of electric lighting on electric trains is the diminution of the light when trains are accelerating; 5 per cent. fall in voltage produces 21·5 per cent. less candle power, whilst 35 per cent. fall in voltage produces 86 per cent. diminution in candle power.

The chief problems of efficient railway carriage lighting are the avoidance of glare in the eyes of passengers and the proper distribution of light. Experiments have recently been made in the shading of railway carriage lighting with good results, but much of the light that should fall on the papers of passengers still passes out through the windows. Lights on the partitions at the backs of passengers are considered the best for reading, but these must be so placed, or shaded, that the light is not an inconvenience to passengers on the opposite seat. With overhead lighting the roof of the carriage should be a flat fawn or cream colour, glossy ceilings produce troublesome reflections of lamp filaments. Horizontal trough lighting, by means of three-sided aluminium troughs with opal glass fronts, is recommended as a suitable luminant for open cars, such as are employed in the tubes. The paper states that a light of 5 foot-candles is desirable for railway carriage lighting.

Railway Platform Lighting.

THE same paper deals with station platform illumination. This varies considerably in various London termini between 0·04 and 4·7 foot-candles. Although stations are usually considered under three heads: (*a*) Terminal, (*b*) big junctions, (*c*) suburban and wayside—in the matter of lighting (*a*) and (*b*) are treated as one. In addition to light adequate enough to enable passengers and staff to see their way clearly about the platform, the lighting must be sufficient to show up the edges of the platform and the carriage footboards to enable passengers

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to alight and join the train safely. For stations in classes (*a*) and (*b*) the paper suggests a minimum light of 2 foot-candles, and in class (*c*) of one foot-candle. The consumption of electric energy to attain these standards is respectively about 0·3 and 0·15 watt per sq. ft., assuming the utilisation efficiency is 50 per cent. "Beacon" lighting is condemned, its efficiency is only 0·005 to 0·06 foot-candle.

It is pointed out that accidents resulting from passengers who step out when trains stop at signals, because they are under the impression that the train has reached a platform, would not result if all stations were adequately lighted. Increased lighting is recommended at barriers (to examine tickets), when the luminant should be 3 foot-candles, at booking office windows (5 foot-candles) and for custom examinations (8 foot-candles). It is suggested that a light of 10 foot-candles be provided for illuminating the name plates of railway stations, and that distinctiveness might be aided by local illumination at night of some specific colour reserved for the purpose. The paper emphasises the necessity of engine cabs and motor men's compartments being unilluminated.

"Too Much Speed for Henry Ford."

UNDER the above heading a recent issue of the *Montreal Gazette* describes in the picturesque language usual with the non-technical press when dealing with railway runs, a journey made by Henry Ford, the "Motor King." Ford, who was in Montreal, it appears, desired to be in Boston by 5.30 p.m. on a certain day. The usual express taking 12 hours to cover the 340 miles, and not being due in Boston till 9.5 p.m., arrangements were made by the Canadian Pacific Railway to attach Ford's private railway car, the "Fair Lane," to the "Dominions Overseas," an express for Chicago, which calls at Montreal West. The train consisted of a baggage car, a coach, and Mr. Ford's private car. No details of weight are given, but the three vehicles would probably weigh less than 150 tons. Montreal West was left at 7.59 a.m. and, having Ford's requirements in view, the engine driver set out to make a record run, but having reached Farnham 38½ miles distant, Ford found the oscillation of his car so considerable that he was unable to partake of breakfast in comfort, and requested that the speed should be reduced during his meal. The paper has a sub-heading: "104 miles between Montreal West and Newport covered in 117 minutes despite reduction." The run was therefore made without intermediate stop at an inclusive speed of 53·3 m.p.h. We are not acquainted with the permanent way conditions or the gradients of this section, but the paper mentions "necessary reductions at stated points." Service speed restrictions are common to all railways, and on the best sections of English railways it is not possible to run a distance of 104 miles without encountering such reductions.

Fast Travelling in Canada.

IN Canada this speed was evidently considered remarkable, but in England (as the table on pages 282/3 of the RAILWAY MAGAZINE for October, 1923, shows) there are numerous daily journeys regularly run for much longer distances at considerably higher speeds. Moreover, our trains are very considerably heavier than the weight of this special could have been. Here are a few specimens of our regular speeds: the 118·3 miles between Paddington and Bristol are covered twice daily in 120 mins. (59·2 m.p.h.); Birmingham and Willesden Junction, 107·5 miles, at the same speed; Marylebone and Leicester, 103·1 miles, at 56·8 m.p.h.; whilst Grantham to King's Cross, 105·5 miles, is performed no less than 16 times daily at 55·5 m.p.h.

At Newport, Vermont, the special was handed over to the Boston and Maine Railway, and after a wait of 13 mins. started on the second stage of its 340-mile journey. The 223 miles from Newport to Boston were performed in 346 mins., the whole journey having occupied 7 hrs. 56 mins. This throughout speed of 42·8 m.p.h. compares unfavourably with the run between Edinburgh and London, the nearest in point of distance for comparative purposes. By the East Coast route, the distance of 392·7 miles (52 miles longer than Montreal to Boston) is covered in 7 hrs. 45 mins., and the 372½ miles, Euston to Carstairs, in 7 hrs. 41 mins.

By the way, the "Fair Lane" was doubtless built regardless of expense, and ought to have been sufficiently well adjusted to enable its multi-millionaire owner to breakfast comfortably at the highest speed attainable on American permanent way. We are indebted to Capt. F. G. Macculloch (Royal Canadian Regt.) for calling attention to this matter.

Traffic Working in the Bradford District.

MR. F. W. LUPTON sends somewhat lengthy notes as to engine and train working in the Bradford district, some extracts from which will, no doubt, be of interest to readers. "Since Bradford possesses no through station, it is to some extent side-tracked, and does not therefore get so many large express engines as other provincial towns of the same size and boasting a through route. The preponderance of small locomotives is

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especially noticeable with regard to Market Street station and the London and North Eastern section of the Exchange station. The majority of trains into Market Street station are worked by the late Midland 0-4-4 tank engines, but a few of the 2-4-0's also make their appearance here. The latest rebuilds of the '428' class of 4-4-0's from Skipton and Lancaster sheds are occasionally to be seen. As regards goods traffic, the late Midland 0-6-0's of the '4,000' class work regularly to Bradford. The London and North Eastern trains working into Market Street station from Harrogate via Arthington Junction, Guiseley and Shipley are generally hauled by the late North Eastern 0-4-4 tank class 'O' engines, with an occasional class 'Q' 4-4-0. Since last summer, sets of S. & D.J.R. coaches have worked daily into Bradford."

Traffic at Exchange Station.

"THE bulk of the passenger traffic into the Exchange station on the London and North Eastern Railway is worked by the late Great Northern 4-4-2 and 0-6-2 (non-superheater) type tank engines, and the two 5 ft. 8 in. 0-6-0's Nos. 5 and 9. The latest grouping development on this section has been the introduction of four of the late Great Central superheater 4-6-2 tanks. These engines, stationed at the East Bowling sheds are Nos. 165, 170, 448 and 450, and take their turns with the other much smaller engines on all types of passenger traffic (including the London expresses). The reason for small engines being mainly employed in spite of the ruling gradient of 1 in 50 in this district may be ascribed to the light loads to be dealt with. The London expresses have under normal conditions 'a maximum' of two through composite corridor coaches coupled with suburban stock, the total tare tonnage rarely exceeding 120. These trains are run as far as Wakefield by Bradford engines, and are then joined on to the Leeds portion for London. The goods traffic is chiefly worked by old 0-6-0's, but there are also three or four of the late Great Northern 0-8-0's shedded here for working coal trains, and recently an ex Great central 0-6-0 has appeared. Perhaps the largest London and North Eastern engine to enter Bradford (Exchange) station came during the late strike. This was the large-boilered ex-Great Northern *Mogul*, No. 1662."

L.M.S. Operations.

"As regards the London Midland and Scottish Section (Western Division "B"), all suburban trains are run by the late Lancashire and Yorkshire 2-4-2 tanks. The main line Manchester and Liverpool expresses, and the 7.30 p.m. Fleetwood mail are worked from Bradford (Exchange) almost exclusively by the Aspinall *Atlantics* and the Horwich rebuilt 4-6-0's, but the 7 ft. 3 in. 4-4-0's are occasionally put in charge. I should think it is unique in locomotive practice for engines with driving wheels as large as 7 ft. 3 in. diameter to be seen daily climbing banks of 1 in 50. This takes place at least twice per day (at 8.28 a.m. and 5.8 p.m.) on the bank which extends for 1½ miles from Bradford to Bowling Junction. The only turns invariably worked by the Horwich four-cylinder 4-6-0's are the Bradford–Marylebone expresses which leave Bradford at 10 a.m. and 5 p.m. Both trains are worked by the same engine as far as Sheffield, returning at 2.54 p.m., and 11.17 p.m., respectively, into Bradford. The Bradford (Exchange)–St. Pancras expresses are run by the large-wheeled 4-4-0's (late Lancashire and Yorkshire) as a rule, but the *Atlantics* sometimes take this turn."

"Four of the Horwich 4-6-0's are stationed at Low Moor (the sheds supplying the Bradford area). These are Nos. 1522, 1524, 10412 (old 1516) and 10452 (new in 1923)—all of the rebuilt type. Late London and North Western *Prince of Wales'* class 4-6-0, No. 614, is shedded here also for express working to Liverpool. *Atlantic* engine, No. 1408, has been experimentally fitted with a whistle similar to the type adopted as standard on the old Caledonian Railway, and is the only engine to be so equipped as yet. Other repainted locomotives at Low Moor besides 10412 and 10452 are as follows: old class '5' 2-4-2 tanks, Nos. 10791 and 10634, and old class '6' Nos. 10905 and 10953; 0-6-2 tank No. 11621 is also here, and several 0-6-0 goods engines have appeared repainted in the new style. Railmotor No. 10609 has been here for repairs, the engine part only having been conveyed to the shed from the Sowerby Bridge–Stainland branch."

Reversed "Mallet" Locomotives on U.S. Railways.

SENDING photograph (not reproduced) of a 2-8-8-2 "Mallet" locomotive as used between Roseville, California, and Sparks, Nevada, by the Southern Pacific Railway for heavy freight traffic, Mr. G. A. Ross, of Oakland, California, adds some remarks as to these engines, the route traversed and operating conditions. There are 49 of these engines in service, together with twelve 4-6-6-2 "Mallet" locomotives used for working passenger trains. Oil is used as fuel, and as this dispenses with the need for the ordinary tender equipment, the engines are designed to run with the cab leading and the chimney behind. A suitable oil and water carrying tender is attached

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behind the engine at the chimney end, while the cab is entirely enclosed and adapted for its leading position. The Sacramento Division main line, including the American Canyon Ogden route, reaches an altitude of 7,017 ft. 4 in. at Summit California. Between Blue Cannon and Truckee this line is practically solid in snowsheds for 41 miles. This line is double track except in snowsheds, but as tracks do not parallel they are called East Bound and West Bound tracks. From Sparks, Nevada, to snowsheds, 48 miles, trains are operated exclusively on the left-hand track. On other parts of the line, except where the tracks recross a few times, they also are really on left track, quite unusual for America. By using locomotives of the class mentioned, smoke interference through the snowsheds is practically done away with. Mr. Ross mentions that the exhaust from these engines has a peculiar sound not at all like other engines, and anyone used to hearing that of other locomotives wonders what a peculiar sound is coming, especially when engines are working hard.

Another interesting point mentioned by him is that between Indio and Calexico, California, the route owned by the Inter-California Railway, but leased to the Southern Pacific Railroad, is for a distance of 98 miles entirely below sea-level. At Indio the minus altitude is 20 ft., at Salton Sea, the lowest point, 202 ft., and at Calexico 2 ft.

Re-Numbering of London and North Eastern Locomotives and Carriages.

WE understand that, with a view to the elimination of duplicate numbers, the London and North Eastern Railway Company has decided to re-number their locomotives with the exception of those built on the North Eastern Section, which will retain their present numbers, up to 2,500. The engines on the following sections will have their present numbers raised by the figure indicated :—

Great Northern Section	..	3,000
Great Central Section	..	5,000
Great Eastern Section	..	7,000
North British Section	..	9,000

Engines on the Great North of Scotland Section will take the vacant numbers at the end of those on the Great Central Section. New locomotives will, generally speaking, be allocated vacant numbers either existing in the North Eastern Section or between 2,501 and 2,999. As an illustration of the effect of this system of re-numbering, the London and North Eastern Railway "Pacific" locomotive which will be exhibited at the British Empire Exhibition, and which was formerly numbered 1,472, now bears the number of 4,472.

As regards carriage stock, new carriages will commence to be numbered from 10,000, but existing vehicles will retain their present numbers followed by a letter indicating the section to which they belonged.

London and North Eastern Railway Meeting.

THIS was the last to be held of the great railway meetings. In his speech to the shareholders Mr. William Whitelaw dealt with various problems of the day. Amalgamation and reorganisation had proceeded smoothly, and the directors were well satisfied with the way matters had been dealt with by the responsible officers. In regard to the placing of orders he explained that, notwithstanding the importance of the manufacturing industries in districts served by the L.N.E.R., when the lowest British prices were 70 per cent. above Continental prices, their hands were, in large measure, forced, though "we shall have to continue to give the most anxious consideration to this difficult and involved question." Reference also was made to staff housing schemes and the proposed housing trust. Proposals to hold the annual meetings consecutively in London, Newcastle and Edinburgh, and that shareholding employees should be allowed to attend the meetings without loss, were negatived. Speaking of the suburban traffic problem, Mr. Whitelaw outlined the difficulties, but the board saw "no immediate cure of what they admitted to be a very serious condition." Various improvements are in hand, including widenings, &c., for which powers are sought, and large numbers of new vehicles are being placed in service.

Comparative Figures of the New Groups.

MR. WHITELAW gave some striking collective figures for the four new groups. The revenue receipts for the past year were £217,000,000, of which the L.N.E.R. proportion was 31 per cent. The number of passenger journeys was over 1,331,000,000, of which the L.N.E. share was 27 per cent. These passenger journeys are equivalent to the whole population of Great Britain having travelled on 31 different occasions during the year. The goods train traffic amounted to nearly 337 million tons, of which 38½ per cent. originated on the L.N.E. line.

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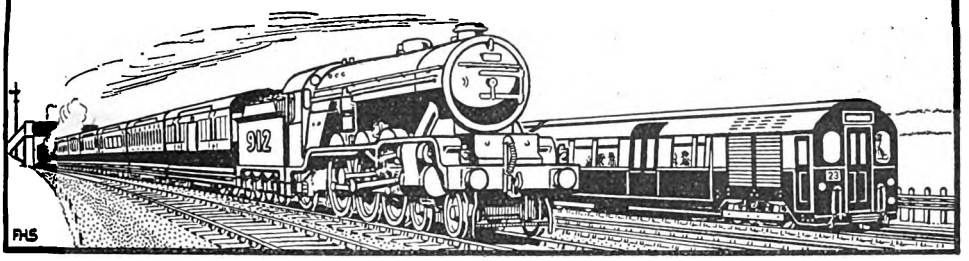
WHAT THE RAILWAYS ARE DOING.



Mr. W. R. MacInnes, Vice-President in charge of Traffic, Canadian Pacific Railway, arrived in England, March 1, on a business visit. Born in 1867, Mr. MacInnes entered the service of the Canadian Pacific Railway on June 8, 1885, as a clerk in the Purchasing Department at Montreal. He was subsequently in the Solicitor's Office from 1885 to 1886; the General Manager's Office, 1886 to 1887, being promoted Chief Clerk to the General Traffic Manager in 1887. In 1896 he became General Agent, Freight Department, and Agent, Canadian Pacific Despatch, at Chicago. He was promoted to the position of General Freight Agent, lines west of Lake Superior, in 1899, Assistant Freight Traffic Manager, Western Lines, in 1901; Freight Traffic Manager, 1903; and in 1918 became Vice-President of the Canadian Pacific Railway.

* * *

Concerning the new Chairman and General Manager of the London Midland and Scottish Railway, the following official statement was issued from Euston on February 29 :—

Sir Guy Granet, G.B.E., was to-day elected Chairman of the London Midland and Scottish Railway, *vice* Lord Lawrence of Kingsgate. Lord Lawrence was elected a director of the London and North Western Railway Company in 1884, and has been Chairman of the London Midland and Scottish group since its inception on January 1, 1923. Lord Lawrence continues as a Director of the London Midland and Scottish Railway.

Mr. Edward Brocklehurst Fielden, of Condover Hall, Shrewsbury, and Mr. George Macpherson, of The Lloyd House, near Wolverhampton, have been elected Deputy Chairmen of the Company.

Sir Arthur Watson has asked to be relieved of his duties as General Manager of the London Midland and Scottish Railway owing to ill-health, and Mr. H. G. Burgess, who has acted for some time as Deputy General Manager, will succeed him pending the completion of the final organisation of the group.

MR. W. R. MacINNES,

Vice-President in Charge of Traffic, Canadian Pacific Railway.

* * *

It has taken little more than a year of "railway grouping" to bring about the first casualty amongst the general managers. Sir Arthur Watson having asked to be relieved of his duties owing to ill-health. Sir Arthur has had a very full railway career. First as Engineer of the old Lancashire and Yorkshire Railway, next as Superintendent of the Line, then as deputy for Sir John Aspinall (when the latter was interned in Germany), and finally as General Manager of the Lancashire and Yorkshire, the London and North Western, and the London Midland and Scottish Railways in rapid succession. Though he was feeling the strain in recent months, Sir Arthur still retained his equable temperament and charm of manner. In his retirement the London Midland and Scottish

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Railway has lost a man of outstanding ability. The staff, moreover, have lost a sincere friend. It is not surprising that the task of organising and administering such an undertaking, when added to the burden of grouping difficulties, has proved too much. This great system comprises over 7,000 route miles of line, extends from London to Wick, from Southend to Donegal, and from Swansea to Goole. The total capital is almost £400,000,000, the gross receipts are over £87,000,000 (or equal to the pre-war revenue of the Indian Empire), and the expenditure over £70,000,000, while the personnel comprises 269,000 employees. In brief, the London Midland and Scottish Railway financial totals represent more than 40 per cent. of the aggregate of the four large companies. The control of such an undertaking has proved too great for the health of its first General Manager. RAILWAY MAGAZINE readers will join us in the hope that now he is freed from the burden of office, Sir Arthur Watson will soon be fully restored to health; and be able to devote the benefit of his wide knowledge and experience to the cause of British railways. A portrait of Sir Arthur was published in these pages in February, 1924 (p. 130), on the occasion of his knighthood.

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THE Right Hon. Henry Givens Burgess, who has become General Manager of the London Midland and Scottish Railway, had been Deputy General Manager as from December 1, 1923. Mr. Burgess is a member of a well-known Tipperary family, and has had a long connection with the London and North Western Railway. He was in charge of general business in Scotland for five years, and for over 20 years served as Irish Traffic Manager. For the same period he also acted as Managing Director of the Dundalk, Newry and Greenore Railway, in which the London and North Western was the principal shareholder. He was also for 16 years a director of the Dublin and South Eastern Railway, and for four years of that period was Deputy Chairman. For 20 years he was an elected Member of the Dublin Port and Docks Board, but resigned when the war imposed special duties in regard to Irish transport. In 1917 he became Director of Transportation of cross-Channel traffic between Ireland and Great Britain, and also acted as the Coal Controller's representative in Ireland. Mr. Burgess was made Director of Irish Transport, Ministry of Transport, in September, 1919, and in consequence of that appointment resigned his position as Deputy Chairman of the Dublin and South Eastern Railway. In 1921 he was again Director, and later in the year Deputy Chairman of the Dublin and South Eastern Railway, although in 1920 he had returned to the London and North Western Railway to be Principal Assistant to the General Manager. On the amalgamation of the London and North Western and Lancashire and Yorkshire Railway as from January 1, 1922, and again on the formation of the London Midland and Scottish Railway as from January 1, 1923, his responsibilities were widened, though his title was unaltered.

* * *

ON February 29 the Great Western Railway directors authorised the following staff changes :—

Docks Department.

Mr. J. H. Vickery, Chief Docks Manager, has retired. For the present the position of Chief Docks Manager will not be filled, but Mr. E. Lowther will take charge of the Docks Department until further notice.

Goods Department.

Mr. E. Ford, Deputy Chief Goods Manager, to be Chief Goods Manager.

Mr. A. Maynard, Assistant to Chief Goods Manager and Development Agent, to be Assistant Chief Goods Manager and Development Agent.

Mr. C. Bassage, District Goods Manager, Bristol, to be General Assistant to Chief Goods Manager.

Mr. F. W. Tyler, Irish Traffic Manager, Dublin, to be District Goods Manager, Bristol.

Mr. E. W. Mauger, Assistant District Goods Manager, Birmingham, to be Irish Traffic Manager, Dublin.

On and from March 3 the Electrical Engineer's Department will be merged into the organisation of the Chief Mechanical Engineer, and Mr. J. R. W. Grainge has been appointed Electrical Assistant to the Chief Mechanical Engineer.

* * *

MR. A. MAYNARD, who has become Assistant Chief Goods Manager and Development Agent of the Great Western Railway, had been Assistant to the Chief Goods Manager and Development Agent from August, 1922. Born in 1882 and educated abroad, he started commercial life in a London shipbroker's office in 1899. Later he served in the South African War, and afterwards joined the staff of C. Shaw Lowell & Sons. With this firm his activities ranged over the whole of Great Britain. Subsequently, Mr. Maynard was engaged on the firm's behalf in France, Holland, Belgium, Scandinavia and Central Europe. He joined

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the Great Western Company's service as District Agent at Nantes in 1909, and later was transferred to the Continental Department at Paddington. In 1914 he was made Goods Agent at Taunton. Some time later he was given a similar appointment in Birmingham, and in 1918 became Goods Superintendent at Paddington.

* * *

MR. H. J. RULE, Assistant and Chief Clerk in the Office of the Superintendent of the Line, Great Western Railway, retired on February 29. He entered Great Western Railway service at Aylesbury in March, 1879. The following year he was transferred to the Trains Section of the Divisional Superintendent's Office, Paddington. In 1902 he was appointed Assistant Stationmaster at Paddington, and in 1904 was transferred to the Office of the Superintendent of the line as head of the Trains and Time Table Department. In March, 1919, he was appointed Chief Clerk to the Superintendent of the line, and he became Assistant and Chief Clerk in May, 1922.

MR. A. MAYNARD,

Assistant Chief Goods Manager and Development Agent, Great Western Railway.

MR. H. J. RULE,

Assistant and Chief Clerk in the Office of the Superintendent of the Line, Great Western Railway, 1922-24.

* * *

MR. H. E. BLAIN, C.B.E., who has become Agent to the Conservative Party, leaves railway and traffic operation with a long and honourable record behind him. His experience began with the Liverpool Corporation, which, when Principal Traffic Assistant on their extensive tramway system he left, in 1903, to become the first Tramways Manager of West Ham. He was a member for several years of the Executive of the Municipal Tramways Association, being President in 1911-12. Mr. Blain's name is associated with a number of commercial and other publications, one on "Office Organisation and Management," of which he was joint author with Prof. Lawrence R. Dicksee, F.C.A., had a large circulation. He joined the "Underground" group in June, 1913, as Purchasing Agent, but in October of the same year was appointed Operating Manager of the omnibus section. In January, 1915, he became Operating Manager for the whole of the "Underground" system, and at the end of January, 1921, was appointed an Assistant Managing Director, having oversight more particularly of all operating activities. Mr. Blain has been connected with many important movements, notably the London "Safety First," of which he was from the beginning one of the joint Hon. Secretaries and subsequently Chairman of the Council, while he took a leading part in the formation of the Institute of Transport, of which he was, until October, 1923, Hon. Secretary.

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STEPS are being taken for the formation in London of a Russian Institute of Transport and Practical Economics. The objects are thus described: (1) To raise the traffic capacity of the existing transport system to a level at which it will meet the demands of the country's trade; (2) to work out a plan for the extension of the transport system, in view of a further development of Russia's productive powers, and (3) to prepare trained technical and commercial personnel for transport. The movement is the outcome of suggestions made by Mr. V. L. Bogdanovitch, 3, Kensington Hall Gardens, West Kensington, London, W.14, who will be prepared to give further particulars to any readers who may be interested.

* * *

THE second annual Bohemian Concert organised by the Metropolitan Railway Athletic Association, held recently at the Queen's Hall, was highly successful. The chair was occupied by Sir Clarendon G. Hyde, a director of the Company, who, during the interval, expressed most aptly the appreciation of all present of the admirable programme, mentioning particularly the names of the Mr. T. Wilding, chairman, Mr. Sidney Brown, hon. musical director, and Mr. W. R. Squire, hon. secretary, with other members of the Concert Committee. He congratulated the Athletic Association upon its satisfactory position. Three years ago it had about 1,000 members, but now numbers over 1,800. The Association was able to hold its own in comparison with other railway athletic associations, and hoped to do even better in the future than it had done in the past.

* * *

AN endeavour is being made by the London Underground Railways to interest the staff in the question of power consumption both on the trains and other equipment. It is realised that in the production of each unit of electricity more than 2 lb. of coal are consumed and that something like 800 to 900 tons of coal are burnt per day at the power station. The power consumed on the trains, escalators, lifts, pumps and lighting, represents an enormous amount, of which 80 per cent. is incurred in train movement. Various educational means have been instituted for the instruction of drivers, by the use of recording ammeters, wattmeters, coasting recorders, &c., and for some time past large charts have been exhibited at the respective depots showing the amount of electricity consumed. A new idea is being tried by showing the amount of current consumed per car-mile in the Weekly Traffic Circular which is distributed throughout the lines, and it is hoped that the men will make a study of these charts. An interesting competition has been commenced in which the staff are invited to write an essay on "Why the consumption varies for the different lines and how it may be reduced." There are many considerations, such as curves, gradients, speeds, station stops, types of car, signalling arrangements, density of service, &c., all of which affect the amount of current consumed.

* * *

THE Minister of Transport has made the following Order: The North Devon and Cornwall Junction Light Railway (Extension of Time) Order, 1924, reviving the powers granted by the North Devon and Cornwall Junction Light Railway Order, 1914, for the compulsory purchase of lands and extending the periods limited by that Order for the same and for the completion of the railway and works thereby authorised.

* * *

WRITING from Arbroath, Mr. Jas. D. Sherriffs remarks: With the advent of the L.M.S.R. several locomotive changes have taken place in the Dundee and Forfar areas, but so far no locomotives have appeared in the new crimson lake livery, although a large number of coaches on the branch lines have changed colour and numerals, and also many of the old six-wheelers have given place to newer bogie coaches, which have been steam-heated all through the winter—an innovation which has received much favourable comment. A few of the older engines have disappeared, notably a goodly number of the old 0-4-4 Drummond tanks, of which only two remain in the district—No. 1227, which acts as "spare" at Forfar, and 190, which still works the Carmyllie Light Railway. Several of the old Oban bogies have also been moved about; 1180 is now acting as "spare" at Forfar—a sure sign that it has almost reached the allotted span—and 1179 was for a time at Montrose, but, having been found unsuitable, has been returned to Dundee West. A 0-4-4 condensing tank, usually associated with Glasgow suburban trains, is also at Montrose, and has changed its number from 93 to 18. Old 0-4-2 No. 1255 is still acting as shunting pilot at Arbroath, although several similar engines—Nos. 1718, 1719 and 1488—have been removed from shunting duties at Glasgow Central, where they have been superseded by 4-4-0 tanks Nos. 5, 6 and 11, which also were employed on low-level suburban trains. Two of these engines, Nos. 7 and 12, are also engaged on

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station duty at Perth in place of old 0-4-4's Nos. 1225 and 1230, which have been scrapped. Several new 0-4-4 tanks are also appearing, No. 418 being on the Dundee and Arbroath Joint, No. 425 at Alyth and No. 426 at Forfar. All the old tanks have been removed from Brechin and their places taken by newer 0-4-4's, viz., 442, 456 and 467. One regrets the passing of these old engines.

* * *

In view of the importance of commercial traffic between Hull and Newcastle, commencing April 1, the restaurant car train leaving Newcastle at 12.10 p.m. for York will be extended to Hull, via Market Weighton, reaching Hull at 3.30 p.m. A corresponding return service will be given by starting the present 4.50 p.m. express from Hull to York at 4.45 p.m., and extending it as a restaurant car train through to Newcastle, due 8.19 p.m. An additional express service between Hull and York will be given at 12.40 p.m. from Hull, connecting at York with through trains to Newcastle, Edinburgh and Glasgow, &c.

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Referring to Mr. Maskelyne's contribution to the March number, dealing with the 0-4-2 tank engines of the Brighton section of the Southern Railway, "Woodbridge" mentions a run a few days previously, when No. 684, working the 9.35 a.m. train from East Grinstead to Victoria and London Bridge, was stopped by signals outside East Croydon station, four minutes early, having covered the 19 miles from Three Bridges, start to stop, in 25 mins. The train was of moderate weight, but weather conditions were adverse. "Woodbridge" also points out that No. 612 of the same class is among the few still carrying a copper-capped chimney.

* * *

Mr. Stanley H. Burns remarks that London and North Western 4-4-2 tank engines are gradually replacing the 0-6-2 tank and 0-6-0 tender engines on the fast trains between Broad Street and Tring.

* * *

"A. D. C.," a reader familiar with the Highland section of the L.M.S.R., states that, in December last, he noticed a permanent way train, an old Highland 2-4-0 engine No. 35A, *Isla Bank*, built in 1863 by Neilsons. He confirms some of Mr. Ahrons' recollections given when he dealt with locomotive and train working on the Highland Railway, particularly in regard to the old system of placing passenger vehicles at the rear of mixed trains. He mentions an instance where, in the case of a train shunting at Achterneed on the Skye line, the passenger vehicles ran away down the bank and did not stop until Dingwall Junction was reached, some four miles back. He suggests that this accident was largely responsible for the change in practice. The real explanation is, however, that when automatic brakes were made compulsory for passenger train working, it became necessary to place passenger vehicles next the engine in order to maintain brake communication.

* * *

Mr. Rex Murphy, of Cork, reports that non-superheated 4-6-0 locomotives Nos. 407-9, Great Southern & Western Railway, are being fitted with superheaters at Inchicore Works; No. 406 of the superheater class built at Inchicore has been fitted with a large tender. The same correspondent also mention that on Sunday, March 2, two specials were run from Dublin to Cork, for the semi-final of the Free State Association Cup. The first consisted of 18 vehicles, mostly corridor, and was worked by four-cylinder 4-6-0 engine No. 406. The second was lighter, taken by No. 404.

* * *

From Brentford, Middlesex, Mr. J. E. Abdey, writes: Looking through some of my old numbers of the Railway Magazine I came across in the November, 1899, issue two photographs of the Oxford and Aylesbury Tramroad's engine "Brill No. 2," and in the January, 1909, another photograph of the same engine as rebuilt and named and numbered "Brill No. 1." It may interest your readers to know that this engine, in practically the same condition as shown in the 1909 photograph, is now working in my neighbourhood in connection with the construction of the new Great West Road, hauling tip wagons of "spoil" on the contractor's road, and railway wagons to and from the contractor's siding on the Great Western Railway, Brentford Branch, situate close to the girder bridge over the new road, referred to in your article on the Brentford Branch in the March, 1924, number. The engine is painted a dark green and has a polished brass safety valve casing of the old Great Northern pattern.

* * *

An item of much interest appeared in the *North Eastern Magazine*, March, 1924, on "Locomotion No. 1," which is at present in the North Road locomotive works of the

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London and North Eastern at Darlington, having been removed there from its pedestal in Darlington Station for overhaul in preparation for its visit to the great Wembley Exhibition, where undoubtedly it will be one of the most sought-for objects. It is learned from the note referred to that the wheels at present under the engine are not the originals that revolved on that memorable day in September, 1825. Wheels, we are told, were troublesome things 100 years ago, and were subject to frequent breakages, and these may have been replaced more than once. Nor is the boiler the same, because in 1828 the boiler burst and had to be replaced. This is not surprising when we find that the so-called "safety valve" was of the most primitive description, being neither more nor less than a heavy ball of iron at the end of a lever. This ball had to be made disproportionately for the work it had to do to allow for the bumping of the engine over the rail joints, so that when the engine was at rest and steam rising it is not remarkable that disaster ensued. Otherwise the old engine is just as it left the shops in Orchard Street, Newcastle-on-Tyne, 100 years ago. The rods and other parts are still as they came straight from the blacksmith's anvil without being machined in any way. The ball and socket arrangement for securing the side rods to the wheels is bound to attract the notice of the engineer visiting the Exhibition.

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MR. G. H. CANNON requests that the reference in the February number to Highland Railway 4-4-0's Nos. 71/72, renumbered 14394/5, be corrected to read 70-72 and 14394-14396, these engines being the three of the "Loch" class built during the war.

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WITH reference to the new Southern Railway colours, Mr. Gordon C. Hector reports that the first engines of the "Brighton" or "B" Section to be painted the passenger green were E4, 0-6-2T tank engines, Nos. 473 and 499 and B2/X 4-4-0 No. 201. Several goods engines have been painted in the standard goods black, the first one to have green lining being C2/X Class 0-6-0 No. 434. Mention was made on page 231 of the rebuilt "B4" class. Mr. Hector gives the complete list as including Nos. 43, 45, 50, 52, 55-57, 60, 70-73. Nos. 55, 60 and 72 have the top-feed pipes outside the boiler, the rest having them inside. No. 72 was the last "B4" to retain the original Billinton funnel, keeping it until rebuilt in December, 1923. Several engines have been recently repainted in old L.B.S.C. colours. No. 53, *Richmond*, has been deprived of its name. Along with several other tender locomotives, it has been equipped with an extended cab roof.

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J. G. S., writing from Sydenham, remarks that a number of "Brighton" 0-4-4 tank engines are working in turn with South Eastern and Chatham engines on the South Eastern section on various suburban duties, for which purpose they have been fitted with the vacuum brake, in addition to the Westinghouse. Among engines he has noted thus engaged are Nos. 363, 372, 378, 379, 388, 389 and 391, all bearing the section letter B. He mentions that "Brighton" 4-4-0 engine, No. 54 *Princess*, has been under repair at the Longhedge works of the South Eastern and Chatham section. J. G. S. further states that he has noted on the Great Northern section, London and North Eastern Railway, 0-6-2 tank engines Nos. 4503 and 1602, fitted with shifting valves similarly to No. 1598 of the same type, and suggests that they have been fitted with superheater boilers to correspond with recent 0-6-2 engines. Reference is also made to 4-4-0 engines Nos. 749 and 19, the former now having a boiler fitted with top feed, while the latter is running with an ordinary boiler, conveying the impression that these two engines have exchanged boilers.

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FROM Palmer's Green a correspondent writes: Grouping has brought about many changes, and the business man who for years travelled by the Great Northern Railway to Finsbury Park, and there changed into a North London train for Broad Street, has had plenty of variety in his morning train rides lately, for he may now travel behind an ex-Great Eastern engine to Finsbury Park and thence to Broad Street with one belonging to the former London and North Western Railway. He may be even lucky enough to have an "all-red" engine and train of the ex-North London Railway for his journey to the City.

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A SWINDON reader reports that Great Western two-cylinder 4-6-0 locomotive No. 2975 has been given the name *Sir Ernest Palmer*, taken from 4-4-0 engine No. 3368. He suggests that the name hitherto borne by No. 2975, *Viscount Churchill*, is to be given to a new engine of the "Castle" class. With regard to the latter class, he and other readers point out that a number of older engines already bear "Castle"

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names. It is probable that so far as the names may be required for new engines, the present holders may be either re-named or run in future without names. Engines of the "County" class are being painted and lined as in the case of the "29" and "40" classes.

* * *

REFERRING to comments in the March RAILWAY MAGAZINE, under the heading "The Decline of the Rail Motor," a correspondent remarks: Of the two Alexandra (Newport) Dock and Railway motors, one has been converted into an ordinary vehicle, but still retains the original engine bogie, minus the motion. This was seen at Caerphilly in October, and it is probable the other has been similarly treated. The two 0-4-0 rail motor engines of the Rhymney Railway were rebuilt some time ago as 0-6-0 well tanks (same-sized wheels), and given Rhymney numbers 120 and 121.

* * *

MR. R. N. MICKLEWOOD reports that "Castle" class 4-6-0 locomotive, No. 4076, *Carmarthen Castle*, Great Western Railway, is in service. Four of these engines are now at work, *Caerphilly Castle*, *Caldicott Castle*, *Cardiff Castle* and *Carmarthen Castle*, Nos. 4073-6. Others may be running by the time these lines appear in print.

* * *

A KINEMA film was shown for the first time in a British passenger train on March 12. The "kinema train" was the down "Scotsman," leaving King's Cross station at 10 a.m. The saloon in which the film was shown had been specially arranged with seats all facing one way. A small screen was fitted at one end of the carriage, and a projector at the other end threw its beam over the heads of the audience in the usual manner. On the journey to York the film "Ashes of Vengeance" was shown. At York the saloon was taken off and returned to London on another train. A second film, "Black Oxen," was shown on the up-journey.

* * *

AT a recent meeting of the Bromley (Kent) Town Council a letter was read from Mr. E. A. Gurney-Smith calling attention to the inconvenience caused by the continued disuse by the railway company of the existing double railway line from Beckenham Junction to both the Crystal Palace and Norwood Junction, and stating that efforts were being made to get such line reopened by two services from Bromley or Beckenham to the Crystal Palace and East Croydon Junction, and asking for the assistance of this Council in the matter. The Highways Committee recommended that representations be made to the railway company in support of the suggestion put forward by Mr. Gurney-Smith.

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THE new Kennington Loop, which is to connect the Hampstead tube with the City and South London tube, will be commenced shortly. Borings are being taken of the soil under the river to determine the nature of the ground through which the new tubes will have to be driven. Just below Hungerford Bridge two barges have been moored and from these engineers are taking borings through a pipe 4 in. in diameter. The pipe enables the soil to be extracted from any depth without interference from water or any other loose material. The new loop, when completed, will provide south-west London with a direct line to Charing Cross and Leicester Square.

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IN the course of his speech at the recent annual meeting of the shareholders of the Dublin South Eastern Railway, the chairman, Sir Thomas Esmonde, Bart., dealt with the damage to the railway arising out of political disturbances. He remarked: Our report informs you that the damage to your property arising out of the recent political disturbances represents, in money, £84,106. The property damaged includes the complete destruction or serious damage of 20 engines, 63 passenger vehicles and 69 goods wagons. The building property which suffered includes four station buildings destroyed. Twenty-one signal cabins were attacked, out of which 10 were completely destroyed. Ten bridges were damaged or destroyed. The permanent way was damaged on 36 occasions, and the telegraph poles and wires suffered on 73 occasions. The Government is making us prompt advances of money according as we make good the damages thus sustained. I do not propose to go into the details of the deplorable circumstances under which the damage and destruction occurred, but I cannot pass from the subject without recording the splendid conduct of our men during the period of the trouble, when they carried out their duties loyally and courageously in the face of personal danger. They deserve our best thanks.

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DURING 1923 the hotels belonging to the Midland Great Western Railway (Ireland) were a source of loss rather than profit. Recess was wholly destroyed, whilst Mallaranny was closed throughout the year, having been occupied for some time by the

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Irregulars and afterwards by the Free State Military Forces. The hotel is now being put in thorough order, and it is hoped to reopen it in the near future and have a successful season. The company are having fresh plans prepared for an hotel at Rossess Point, the building of which had been commenced, but which had to be suspended during the war.

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THREE English passengers lost their lives in the wreck of the Calais-Mediterranean express at a junction near Lyons on March 10. The story of the engine driver, Bocquet, as published in *The Times*, is clear and dramatic in its revelation of the immediate circumstances of the accident. Bocquet, who has known the line for 15 years, said :—

" On coming out of the Collonges tunnel, I was supervising the stoking, as the fireman was not experienced in working an express. As I lifted my head, being perhaps dazzled by the glare of the fire, I saw what I thought was a white disc (white is the signal indicating that there is no danger). Then suddenly I saw the signal at the bifurcation, then the green danger disc. I felt we were lost. I jammed the brakes. We jumped the points. The engine ploughed up the track. I felt it hesitate an instant or two, and then a tremendous noise occurred, which I hardly heard at the time, but which buzzed in my head long afterwards. The engine leant over and then fell. We jumped out, but not in time to escape the jets of steam bursting out from the smashed pipes."

The engine driver further asserted that he was expecting the train to travel to the Perrache station at Lyons, and that his route instructions given to him at the Dijon station showed this. From the junction of Les Grands-Violets, besides the main line going to the Lyons Perrache station, there is a loop line going to the Lyons-Brotteaux station. The main line continues straight past the junction and can safely be taken at speed. If the train is to be diverted on to the loop line, however, the speed must be diminished to 30 kilometres (18½ miles) an hour. Bocquet, believing that he would go on the direct line, made no preparations for slowing down. Neither at Dijon nor at Mâcon was he warned that he would be diverted on to the loop line.

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A FILM has been produced under the direction of the Southern Railway and Zeeland Steamship Company, entitled " An Island Paradise." It is to be shown in kinemas and is intended to encourage British people to spend their holidays on the Dutch island of Walcheren, which deserves to be better known as a holiday resort. Fine stretches of sand, old-fashioned towns—Flushing, Middelburg, Koudekerke, Westkapelle, to name a few—charming walks, historical buildings, good hotels and golf links are among the many attractions for visitors. Special attention is drawn to the comfortable travelling facilities which exist between England and the Walcheren by the Southern Railway and the Zeeland Steamship Company's steamer route.

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SINCE the railway grouping came into force fifteen months ago, the time-tables of the London Midland and Scottish Railway (which now comprises 5,001 stations, 2,598 passenger and 2,403 goods, apart from Ireland) have been available to the public only in three sections, one volume each for the Western, Midland, and Northern divisions of the line respectively. Work has been in progress for some time with the object of combining all three into one volume to cover the whole system, and this will be achieved in time for the next issue. The three-volume time-table contained 735 pages in all, and involved an outlay to the public of 9d., or 3d. for each volume. The combined volume will comprise about 500 pages and will be sold at not more than 6d., although the cost to the company is considerably more than that sum. The size will remain as now, so that the new volume will be one of the largest railway guides in the world. It will present some 32 square yards of printed matter, dealing with passenger services by rail, road, sea and lake. It will also comprise eight double-page maps. Special trouble has been taken in the selection of paper and type with a view to yielding the greatest legibility, and there will be no advertisements.

* * *

To handle highly technical questions without being dull is beyond the powers of the ordinary run of lecturers, but members present at the March general meeting of the Railway Club, 65, Belgrave Road, S.W.1, had no cause for complaint on this score, although the subject for consideration was " The Application of Scientific Methods in Railway Signalling." In the capable hands of Mr. Lionel Hiller this proved a very " live " theme and at the conclusion he was thanked and congratulated very heartily. The chair was occupied by Mr. L. H. Bailey.

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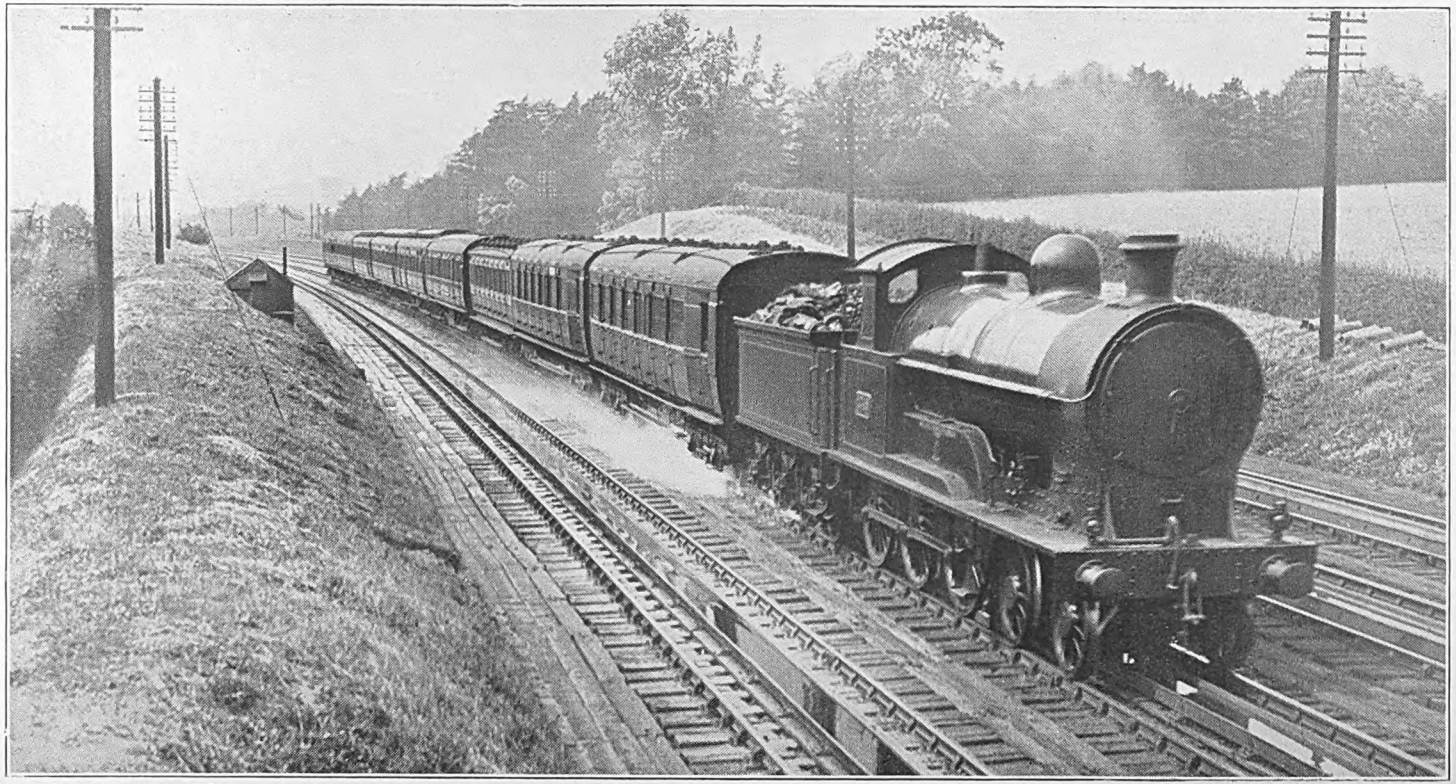

THE RAILWAY MAGAZINE] [*Photo. by Leslie J. Thompson.*

TAKING WATER AT CASTLETHORPE TROUGHS.

London Midland and Scottish Railway, Manchester-London Express.
Train includes former Midland, Lancashire and Yorkshire, and London and North Western Coaches.
4-6-0 (L. & N.W. Section) locomotive, No. 1749, "Precedent."

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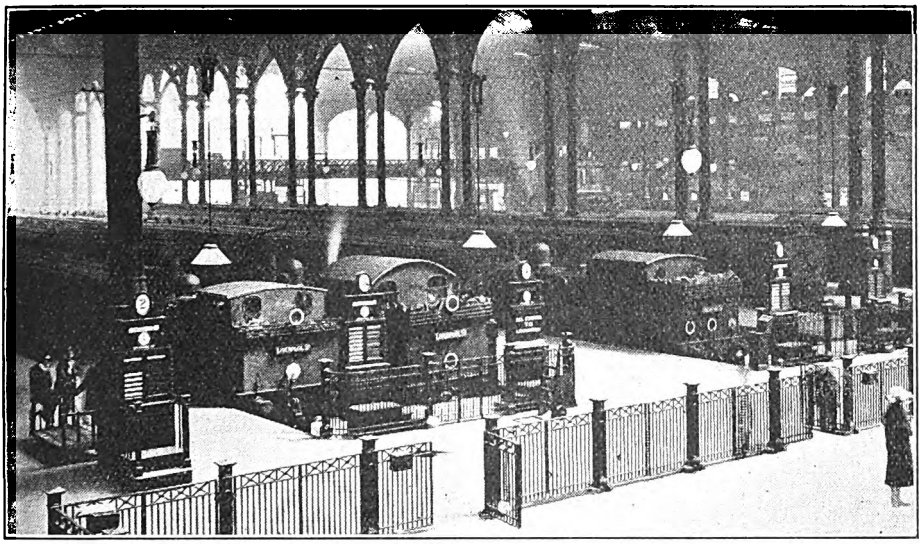

INNER CIRCULATING AREA AND NEW GATES TO PLATFORMS 2-6.
Also showing new "Pedestal" Train Indicators as used for Suburban Trains.

Jubilee of a Great London Terminus.

LIVERPOOL STREET, LONDON & NORTH EASTERN RAILWAY.

By J. F. GAIRNS, M.I.Loco.E., M.Inst.T.

ON February 2, 1874, Great Eastern Railway suburban traffic was transferred from the old terminus at Shoreditch to Liverpool Street, so that the busiest railway terminus in the British Isles, and, therefore, probably in the world, has just celebrated its Jubilee. When opened fifty years ago the station was, of course, smaller than it is to-day, though even then it had nine platforms, indicating anticipations of considerable traffic developments, though no one responsible at the time could have been expected to take into account traffic volume and statistics such as those which the twentieth century has witnessed. On November 1, 1875, the main line traffic was also taken over from Shoreditch, which was then closed and used only for goods traffic (it is incorporated in the present Bishopsgate Goods station). Yet, before the 'eighties were out, it became necessary to consider enlargement, with the result that in April, 1894, twenty years later, eight further platforms were added, with additional approach lines and other developments. In this form Liverpool Street for a number of years held the record for number of platforms, though in that respect it has had to give place to Waterloo as well as to several other stations in various countries. Liverpool Street is still, however, the busiest of the great termini in respect of numbers of passengers, while traffic operation is now rendered difficult for lack of further platform and approach accommodation.

The construction of the original Liverpool Street station was associated with the building of the Hackney Downs group of lines (*see* RAILWAY MAGAZINE, October, 1922). In conjunction with the policy of developing suburban traffic, then beginning to manifest its possibilities, steps were taken in the early 'sixties for the construction of a larger and more suitable terminus than that at Shoreditch, which at that time was not only more inconveniently situated with regard to the City than it is to-day, but was located in a distinctly insalubrious neighbourhood. At one time it was proposed to extend as far as Wormwood Street, but eventually it was decided to terminate alongside the then

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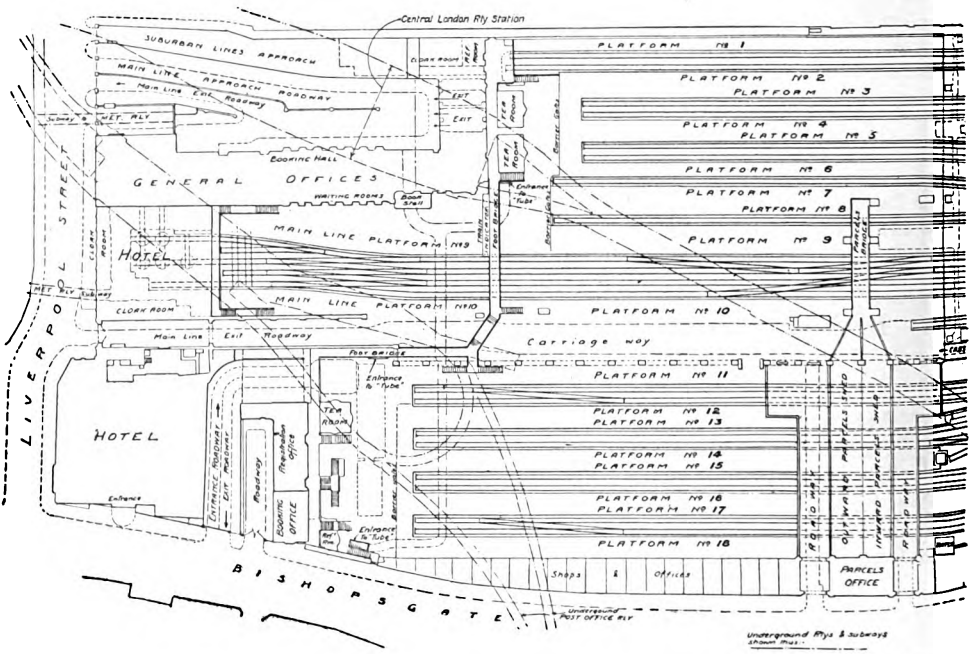
new North London Broad Street station. Owing to the attitude of the City Corporation and other bodies it was necessary to descend a steep gradient all the way from Bethnal Green, so as to pass below the goods station and under various thoroughfares, though arriving passengers have then to ascend to reach street level. The disadvantage thus created has always been somewhat of a handicap to traffic working at Liverpool Street, in that although it is but seldom that engines become "stalled" on the 1 in 77 grade, longer time is necessarily taken to clear

"Through," the present "Suburban" lines, though on the western side, having been constructed in connection with the building of the East Side station. Nos. 9 and 10 were the main line departure and arrival platforms, respectively, these two platforms, together with the two middle lines, being extended back to the hotel, as at present. The other platforms were of ordinary length, but Nos. 1 and 2 lines continued in a tunnel to join the Metropolitan Railway close to its Liverpool Street (then known as Bishopsgate) station. This tunnel was built with a



PLAN OF LIVERPOOL .

the sections. As Lord Claud Hamilton has several times explained, the hands of the directors and officers of the period were, in this matter, forced, with the result that traffic operation has been handicapped and passengers inconvenienced more or less ever since.

The original station had nine platforms, though there are now ten in that portion. These connected with four lines up the bank to Bethnal Green, where the Stratford and Hackney Downs routes diverged, each being two-track only until some years later. The four lines in question were those now known as "Local" and

view to through running, and for a short period Metropolitan trains worked through to Stoke Newington. This was, however, merely a temporary arrangement, in view of the extension from Moorgate Street to Aldgate. The Metropolitan end of this tunnel can still be seen. At Liverpool Street the tunnel remained until 1920, and was occasionally used for stabling purposes, though the Metropolitan connections had long since been taken out. A part is now used for additions to station premises at Liverpool Street. The remainder has been utilised to accommodate a staff recreation room and gym-

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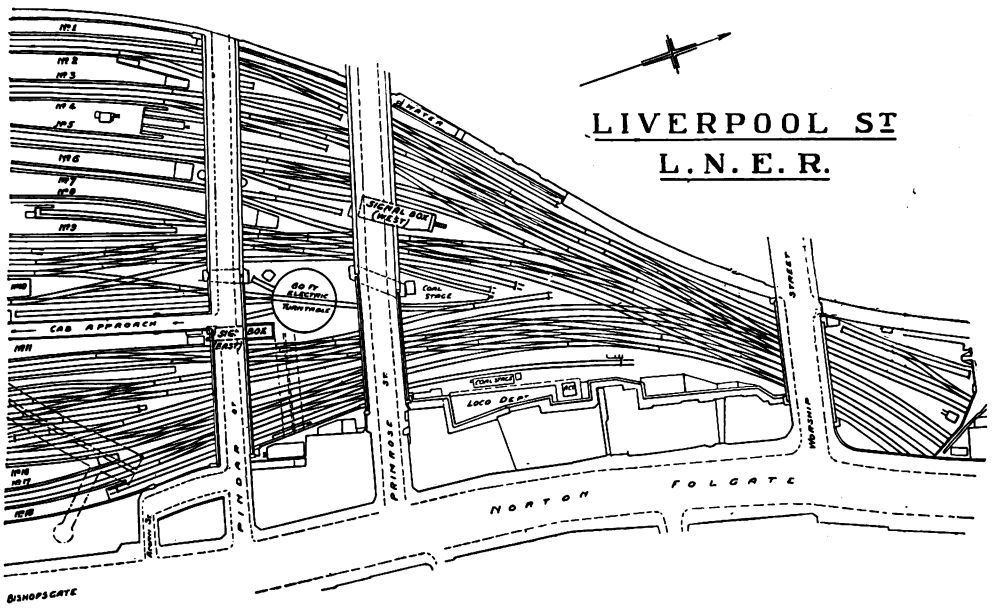
nasium, class rooms, and staff dining rooms.

The first traffic transferred to Liverpool Street was that of the Enfield and Walthamstow branches, on which, following the completion of the Hackney Downs route in August, 1872, a fairly heavy service had been instituted—too much, in fact, for the old Shoreditch terminus. From Liverpool Street, however, very full services, for that period, were given on these routes, in regard to which a suburban traffic development policy was adopted from the first, the result, in conjunction with the generous workmen's and cheap and half-fare facilities in force for so many years, being the tremendous growth of the areas thus served. As regards other suburban routes, the Loughton branch was already well served from and to Fenchurch Street, as also the then very busy Woolwich line, so that the diversion to Liverpool Street and development of the former was more gradual, while Woolwich branch traffic, which has changed essentially in character, is still mainly dealt with at Fenchurch Street. Development of Ilford line traffic has been almost entirely associated with Liverpool Street, as it was a comparatively small factor until the opening of the new terminus rendered it practicable to cater for it. Now, however, with the great extension of housing between Forest Gate and Chadwell Heath the Ilford route traffic has become a very big and difficult factor in itself.

The suburban developmental policy adopted in those days brought its reward, with the result that before twenty years had passed it was necessary to enlarge the station. With the addition of eight platforms, Nos. 11-18, Liverpool Street became the largest in the British Isles, and although it has had to give place to Waterloo in this respect, it is still the most compact—too compact, indeed, in the sense that there is no scope for further development—of all the great termini, and deals with the largest daily and annual numbers of passengers.

Associated with the enlargement was the provision of two more running lines to Bethnal Green. These were the present "suburban" lines, necessarily on the west side, though the station enlargement was on the east side, so that entire rearrangement of connections had also to be made. The wise policy was adopted of



STREET STATION, L.N.E.R.

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VIEW ACROSS CIRCULATING AREA, WEST SIDE.

organising the station to a great extent in three traffic sections, associated with one or other set of approach lines, also taking into account junction conditions down the line and utilising them to effect any further transfers required. This involved, too, the breaking down of the convention that "fast" lines were for "express" trains only, and the building up of train services taking into account the line upon which it was most convenient to run each train.

As a result, until 1920, when important changes were made, platforms Nos. 1-6 connected with both "suburban" and "local" lines; Nos. 7-14 connected with either "local" or "through" lines; and Nos. 15-18 served only the "through" lines, while traffic was usually allocated thus: Nos. 1-4 "suburban" lines and slow lines from Bethnal Green to Hackney Downs; the "local" lines carried Loughton or Hertford line trains via Stratford from Nos. 5 and 6; and from Nos. 7-14, Cambridge line expresses, Hertford line trains via Hackney Downs, and occasional fast Walthamstow or Enfield trains using the "fast" lines from Bethnal Green to Hackney Downs (also empties for Stratford); and the "through" lines received practically all Ilford line suburban trains, together with the Colchester main line, Southend and other trains. If a Stratford or Ilford train (passenger or empty) leaves Liverpool Street on the "through" lines, it can transfer to "local" lines at Bethnal Green and thus reach also the "fast" lines to Hackney Downs. Almost any interchanges can, in fact, be made at Bethnal Green, as well as further down, but in practice these are seldom made during busy hours, while the non-distinction between "local" and "express" trains causes practically all Loughton line "fasts" to travel "local" line throughout, Cambridge line "expresses" to use the "local" lines to Bethnal Green, while many Ilford line "locals" travel "through" line, so that only such trains requiring to call at Bethnal Green or Coborn Road, which have no platforms on the "through" lines, need to transfer between "through" and "local" lines at Bethnal Green.

While these methods still apply very largely, several changes have been made recently. Thus, in conjunction with the alterations and improvements made when the "intense" working of Enfield and Walthamstow line traffic was adopted in July, 1920, trains from Nos. 1, 2 and 3 platforms at Liverpool Street use the "local" lines only in case of emergency. A new connection from the "suburban" lines at Bethnal Green direct to the Hackney Downs "fast" lines has been put in to avoid any conflict with the Stratford traffic, and no Enfield and Walthamstow trains now use platforms other than Nos. 1-4. Trains from or to No. 4 still occasionally use the "local" lines. Nos. 5 and 6 connect only with the "local" lines. Other connections remain as formerly.

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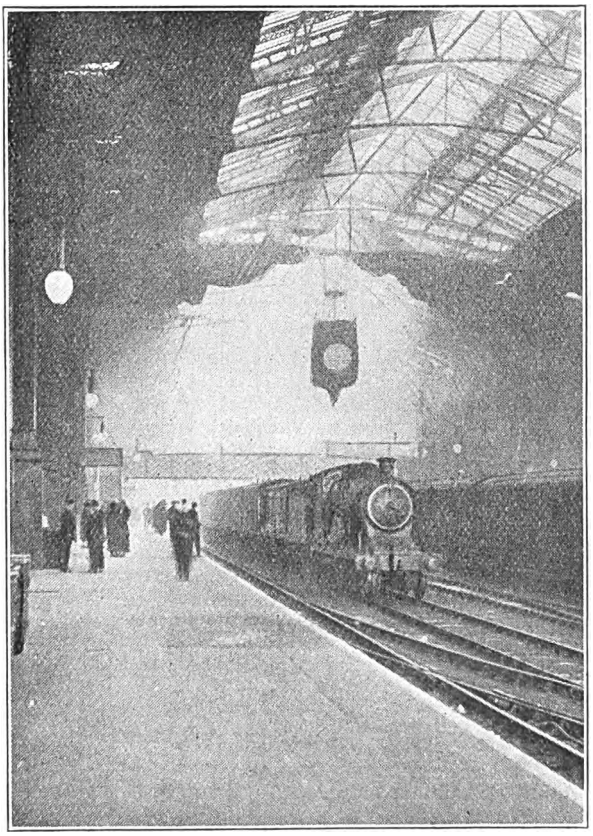
Platform allocation is, however, more rigidly adhered to even than in earlier days, while the old distinction between departure and arrival platforms has largely disappeared, owing to the practice of using incoming main line trains for outward journeys after a sufficient interval to allow of general cleaning, renewal of lavatory water supplies, &c., proceeding concurrently with the unloading of luggage, &c. As a result, platform occupancy need not be much more than formerly, while journeys as empty sets to and from the carriage sidings at Stratford are largely avoided during the busy hours.

The general allocation of platforms and the lines they feed are therefore now as follows :—

No. 1. Enfield and Palace Gates. "Suburban" lines only.
No. 2. Walthamstow and Chingford. "Suburban" lines only.
No. 3. Enfield and Palace Gates. "Suburban" lines only.
No. 4. Walthamstow and Chingford. Usually "suburban" lines only, but can use "local" lines. Occasionally Loughton and Hertford trains use this platform.
No. 5. Loughton line trains. "Local" lines only.
No. 6. Loughton line trains. "Local" lines only.
No. 7 (double-sided) } Used for additional Loughton line, Hertford, Cambridge main line, Colchester main line, Southend, and other trains. "Local" or "through" lines.
No. 8 (double-sided) }
No. 9 .. }
No. 10 .. }
No. 11 .. }
No. 12 .. }
No. 13 .. }
No. 14 .. }
No. 15 .. } Ilford line "locals," Southend and main line trains as required. "Through" line only.
No. 16 .. }
No. 17 .. }
No. 18 .. }

It is only very exceptionally that any Woolwich trains are now dealt with at Liverpool Street, there being only two or three scheduled trains daily, though changes for that line can be made at Stratford. Boat specials to or from the Royal Albert Docks and Tilbury Docks are, however, frequently run. Also there are now no East London line trains, except occasional specials, horse-box trains, &c., and during the night several goods trains brought into Liverpool Street for reversing purposes. At one time London, Brighton and South Coast trains on East London service worked into Liverpool Street, but more recently they terminated at the East London Shoreditch station, so that only Great Eastern trains to and from New Cross and Croydon used the Great Eastern terminus, and even these services were discontinued when the East London line was electrified.

Liverpool Street traffic now includes some 1,180 trains daily, with additions to meet summer and holiday pressure. During busy hours both Enfield (including Palace Gates trains) and Walthamstow and Chingford lines have 12 trains each way hourly, all these being confined exclusively to the "suburban" lines, though utilising the four-track facilities between Bethnal Green and Hackney Downs. At other times these routes each have a ten-minute



VIEW IN MAIN LINE STATION FROM No. 10 PLATFORM.

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service, a frequency which is much envied by travellers on other routes, especially those which have to be satisfied with half-hourly trains middle-day and late evening. On the Loughton line the busy period average is about eight trains hourly, chiefly at Nos. 5 and 6 platforms, while the Ilford route (for stations from Maryland Point to Gidea Park and Brentwood) about 12 trains hourly. The Hertford route has from two to four trains hourly, and the Southend line practically a half-hourly express service, with stopping trains in addition, which share in the Ilford route outer suburban traffic.

As regards the main lines, the principal Cambridge line expresses are the 8.30, 10.5, 11.50 a.m., 2.34, 4.45, 5.49, 7.10 and 10.12 p.m. (mail train) from Liverpool Street, some of these having restaurant or Pullman cars, or both. Many of these are heavy and important trains, but do not require amplification to the same extent in summer as in the case of the favourite Colchester line expresses. These are based on the 5.0, 8.15, 10.0, 11.30 (Saturdays only), 11.56 a.m. (not Saturdays), 12.25 (Saturdays only), 3.10, 3.15, 4.55, 5.18 and 7.45 p.m. expresses for Ipswich or beyond, together with the Continental boat expresses at 8.30 and 8.40 p.m. and the 10.26 a.m., 12.35 (Saturdays only), 1.30 (Saturdays only), 3.20, 4.58, 5.30 (except Saturdays), 6.39 (except Saturdays), 8.45 p.m. and 12.0 (midnight, Saturdays only) Clacton-on-Sea and Walton-on-Naze expresses. In summer, however, these trains develop into a notable series :—

a.m.
5.00. Ipswich, Norwich, Yarmouth, &c.
8.15. Norwich (third-class Pullman car), Cromer, Sheringham and Yarmouth (restaurant cars).
9.50. Cromer (restaurant cars), Sheringham and Mundesley.
9.55. Yarmouth and Lowestoft (non-stop to Beccles).
10.00. Ipswich and Yarmouth line stations.
10.12. Felixstowe (third-class Pullman car) and stations Ipswich to Norwich.
10.20. Intermediate main line train to Yarmouth.
10.23. Clacton-on-Sea (third-class Pullman car) and Walton-on-Naze.
10.26 (Saturdays only). Clacton-on-Sea non-stop (restaurant cars).
11.26 (Saturdays only). Clacton-on-Sea.
p.m.
12.25. Cromer (restaurant cars), Sheringham and Overstrand. Non-stop to North Walsham.
12.30. Yarmouth (restaurant cars). Non-stop throughout.
12.33. Harwich, Norwich, Cromer (restaurant cars) and Sheringham.
12.36. Clacton-on-Sea and Walton-on-Naze.
12.56. Lowestoft (restaurant cars) and Felixstowe.
1.00. Yarmouth and Lowestoft, Aldeburgh.
1.30 (Saturdays only). Clacton-on-Sea (restaurant cars) and Walton-on-Naze.
2.03 (Saturdays only). Clacton-on-Sea and Walton-on-Naze.
3.10. Norwich, Cromer (restaurant cars) and Sheringham.
3.15. Yarmouth and Lowestoft.
3.18. Felixstowe (restaurant cars), Yarmouth and Aldeburgh.
3.23. Clacton-on-Sea, Walton-on-Naze and Harwich.
4.55. Yarmouth (restaurant cars) and Lowestoft.
4.58. Clacton-on-Sea (restaurant cars) and Walton-on-Naze.
5.18. Norwich, Cromer (restaurant cars) and Sheringham.
5.30. Clacton-on-Sea and Walton-on-Naze (restaurant cars).
6.39. Clacton-on-Sea (third-class Pullman car) and Walton-on-Naze.
7.45. Ipswich (restaurant cars).
8.30 Hook of Holland continental express (restaurant and Pullman cars).
8.40. Antwerp and Zeebrugge continental express (restaurant and Pullman cars).
8.45. Clacton-on-Sea and Walton-on-Naze.
Midnight.
12.00 (Saturdays only). Clacton-on-Sea and Walton-on-Naze.

These make quite an array of notable trains, but, in practice, especially on late July and August Saturdays, reliefs are frequently required, especially to the morning services. In fact, it is quite usual for several suburban trains to be cancelled on those days (there are usually fewer passengers to be carried by them), mainly to release platforms for main line additions. As a result, one may find a main line train at No. 5 or 6, or a Yarmouth non-stop at No. 18, with other indications of the extreme pressure, while the crowds of passengers for the holiday trains sometimes render it a difficult task for arriving business passengers to make their way through. At such times, indeed, every square foot of the relatively generous circulating space seems to be occupied, and that on both sides of the station, while the famous footbridge is not easily traversed, owing to the large numbers of passengers moving from one side to the other.

Such conditions are, of course, exceptional, though by no means infrequent at

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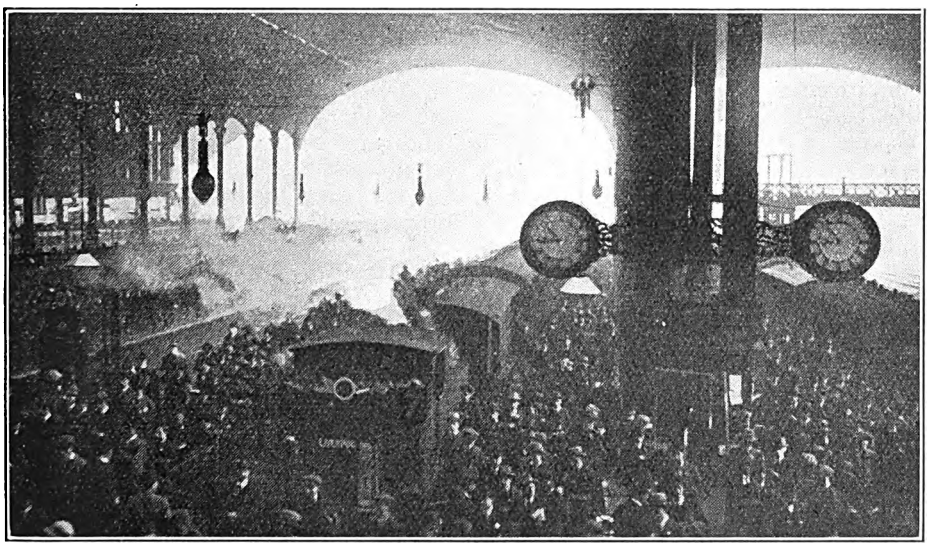
holiday periods, but they have their daily counterparts as the morning crowds of business people arrive, on Saturday afternoons, and during the evening return pressure, except that there is not so much luggage to be dealt with, and most regular passengers know their trains and platforms, and so quickly disperse from or distribute themselves to the platforms. Even on an ordinary winter working day, however, it is an illuminating sight to watch, say, from the windows of one of the now well-known and popular "Tea Rooms," the arrival or departure of train after train, with platforms one moment a solid mass of humanity, the next relatively clear, and so on alternately every few minutes. It must be remembered that practically every suburban train during the busy hours seats about 850 passengers, and frequently conveys 1,000, so that it becomes easy to appreciate the fact that an ordinary daily total of passengers using Liverpool Street station is about 280,000, and in one busy hour 50 arriving (morning) or departing (evening) trains may convey almost if not quite 40,000 passengers, all passing over three down or three up lines according to the direction of pressure. It is estimated that about 80,000 season tickets are available at Liverpool Street, while about 50,000 ordinary tickets are issued daily.

Liverpool Street also has its share in special traffic. Boat trains are frequently run to the Royal Albert Docks and to Tilbury in connection with various steamship sailings, while occasionally Midland (London, Tilbury and Southend) trains come in as boat specials from Tilbury Docks, these trains being run to Liverpool Street as more convenient than Fenchurch Street, as a result of an old arrangement. "Tottenham Hotspur" football matches entail a heavy demand for tickets to White Hart Lane, while in the winter months there are many football passengers for other stations. In the summer, and on Bank Holidays, a tremendous traffic is conveyed to Epping Forest stations, including large numbers of private special trains. In addition to the ordinary holiday traffic, thousands of children are sent to country destinations by the Children's Summer Holiday Fund and other organisations, as also to seaside holiday homes. There are also Continental services other than those by the company's steamers using Parkeston Quay, while race-meeting traffic to Newmarket and other courses is at times a very important factor. Now and then royal specials to Wolferton (for Sandringham)



A BUSY MORNING SCENE: ARRIVALS ON Nos. 7 AND 8 PLATFORMS.

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are dealt with at Liverpool Street, though usually these are run from and to St. Pancras. Finally, emphasis must be laid upon the workmen's and excursion traffic, both of which count for a great deal at Liverpool Street.

Parcels traffic is also a very large item, some 5,000,000 packages being handled annually by the Parcels Department. The Cloak Rooms deal with some 330,000 items annually. Large quantities of milk, fish, meat, fruit, market produce, &c., are received or transferred, while newspaper packages, Parcels Post traffic, horses, &c., show heavy totals in the course of twelve months.

So far we have been concerned mainly with traffic aspects, but a few notes are necessary in regard to the station itself, especially in view of the many alterations and improvements which have been made during the last few years.

The present-day Liverpool Street station occupies an area of about 16 acres, and is bounded in front by Liverpool Street, on the east by Bishopsgate, and its continuation Norton Folgate, and on the west by a public footway separating it from the premises of the adjoining Broad Street station. The road bridges which carry Pindar Street and Primrose Street across the width of the station may be said to constitute the northern limits of the station, though really its track connections and signals extend to the tunnels and bridges associated with the old Bishopsgate station (closed). Working is controlled by two signal cabins, the West Box, with 240 levers, and the East Box, with 136. Both are mechanical, with, however, a complete equipment of indicators, &c. The West Box controls the whole of the main station, while the East Box is concerned with the working of the East Side station, though it is subsidiary to the West Box for train departures and arrivals and for movements other than those within its own sphere. The West Box is located under the Primrose Street bridge, approximately between Nos. 6 and 7 platforms. The East Box is adjacent to the turntable, on the eastern side of the inward cab road from Pindar Street to the road between Nos. 10 and 11 platforms.

From Liverpool Street itself the main entrance is through three of the four sets of gates opposite the Metropolitan Railway station. The set nearest Broad Street station leads to a road level yard serving the old suburban booking office, but as the latter has been removed to a lower level this yard is now closed, except that the separating wall has been removed for a short distance, so that the gates can be used as a further entry for passengers passing down the slope served by the second set of gates. The latter admit incoming cabs as well as controlling a wide pavement down or up which a large proportion of passengers enter or leave the station. The third set of gates correspondingly provide for outgoing cabs and govern another pavement for foot passengers, though less used than that previously mentioned. The fourth set of gates gives access to a small yard at the entrance to the General Offices. The buildings ranked when new as remarkable, and are still distinctive, though their stonework has been darkened by London smoke, and their artistic design is but little noticed. With the clock tower and other embellishments, they present quite a satisfactory appearance as viewed from the head of the slope.

At the foot of the slope, and passing the covered yard alongside the main booking office, passages lead into the suburban part of the station. To the left, in space taken from the old tunnel already mentioned, are a large cloak room, and staff and public refreshment rooms, while straight on are passages, one serving the new suburban booking windows, and the other two enabling passengers to enter or leave without hindrance. This part has been very much altered recently, in order to give greater freedom of movement by the removal of a cloak room, &c., which at busy periods seriously hindered the free movement of passengers. The cab yard proper is somewhat to one side, the main booking offices, together with a main line luggage department, being alongside the inner portion of No. 9 platform. The yard is also served by a subway connection with the Metropolitan station, used by very large numbers of passengers.

The main line booking office is a large and lofty hall. One end is occupied by the beautiful memorial to Great Eastern servants who gave their lives in the Great

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War, flanked by smaller memorials to Captain Fryatt and General Sir Henry Wilson, who was shot after having officiated at the dedication service for the Great Eastern memorial. At the other end are time-table stands, with individual lighting, as located in several places about the station. The main booking offices are in one block, on one side of the hall. Opposite them is the postal and telegraph office. Booking windows are also available outside, on No. 9 platform. Alongside the luggage office, and with access both from the booking hall and from No. 9 platform, is a large public enquiry office, a valuable and much-

Street itself, where the main public entrance to the offices is situated. Adjacent to the footbridge which spans the whole of the station, certain premises are used as a grill room, as well as providing further waiting room space. At the buffer stop end of Nos. 9 and 10 platforms, which extend much further back than any of the others, are various platform-level premises, including a cloak room, and a passage-way by which passengers can pass round from one side of the station to the other without using the footbridge. From No. 10 there is a passage-way giving a second subway connection with the Metropolitan station.

CONTINENTAL BOOKING AND INFORMATION OFFICE.

appreciated addition to the station facilities. Continental bookings are now dealt with here. Emergency booking offices are provided outside the booking hall on the cab yard side, and these are always required at holiday times, being otherwise utilised for the issue of race-meeting, football, excursion and other tickets.

Other premises in this block of buildings are the older refreshment, dining and tea rooms reached from the circulating area, ladies' and other waiting-rooms, the stationmaster's office, and an entrance to the General Offices. The latter occupy most of the upstairs space and extend over the main booking hall to Liverpool

Under the hotel buildings Nos. 9 and 10 platform lines, with two middle roads, have turntable connections with lines used for the loading and unloading of horse boxes, while two or three short spur lines accommodate wagons for refuse, and for hotel purposes. A footbridge connects Nos. 9 and 10 platforms, and gives direct access to the hotel premises, and a further entrance to the general offices.

Between Nos. 10 and 11 platforms is the old cab road to meet the needs of arrival traffic. This commences by a slope down from Pindar Street bridge, and leaves by a slope up to Liverpool Street. At the

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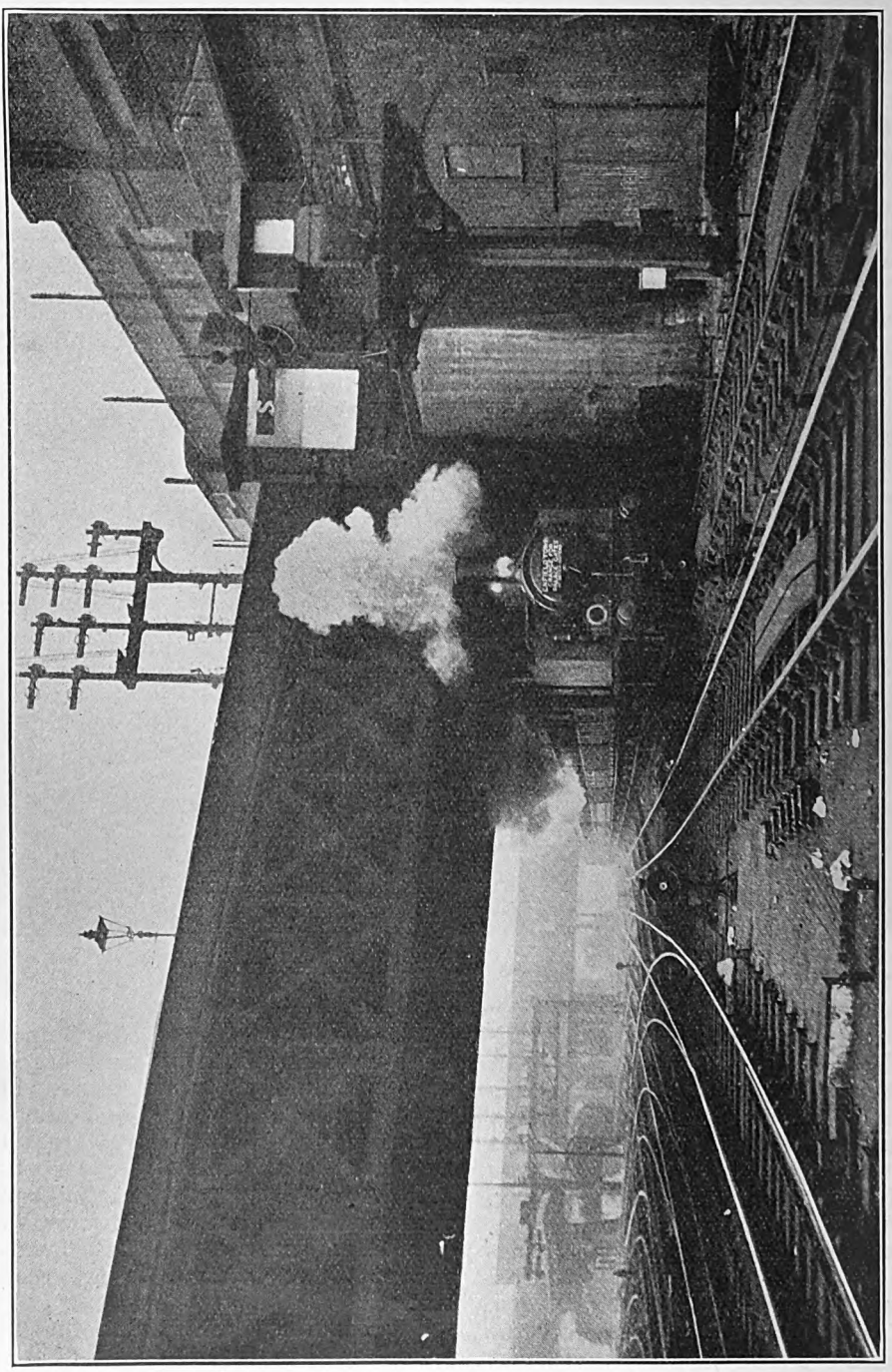

TRAIN LEAVING LIVERPOOL STREET STATION ON DOWN "SUBURBAN" LINE.
Showing also "Up Suburban" Route-Indicating Signal.

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outer end of No. 10 line, alongside the Pindar Street slope, are engine lines, connecting with the turntable just beyond, close to the East Box. Although located on the western side of the pillars and abutments which support the roof on that side of the original station boundary, the cab road also serves No. 11 platform, which for that reason constitutes a second main line arrival platform, though, as already mentioned, both of these platforms are now often used for important departures.

Platforms 11-18 extend a short distance further back than Nos. 1-8, though not so far as Nos. 9 and 10, so that their circulating area is not level with that behind Nos. 1-8, and the footbridge bends to follow the line of station buildings. These include, on platform level, tea and refreshment, waiting and cloak rooms, with booking offices at footbridge level entered directly from Bishopsgate alongside. Behind these buildings an inclined cab road provides for cab entrance and exit to and from a small cab yard opposite the ends of platforms Nos. 11 and 12. Behind this road and extending round the corner from Bishopsgate Street into Liverpool Street, and as far as the General Offices, are the main hotel premises, partly with shops on street level. The hotel has two main entrances, that to the hotel proper from Liverpool Street itself, and that to the Abercorn Rooms in Bishopsgate. There is also access from the station direct, as already indicated. By sheer merit the Liverpool Street Station Hotel has come to be regarded as one of the most popular rendezvous for business visitors to London, as well as a favourite residence for tourists and travellers to and from the Continent. The public dining and grill rooms are always used to full capacity by City business people, as well as by hotel residents, while the Abercorn Rooms have proved exceptionally popular for public dinners, balls, and other functions.

From the foregoing it will be seen that, although Liverpool Street station is single-ended, the only entrance from the outer end, and that little used by the general public, being by the cab road from Pindar Street, it is well served on all sides at the terminal end. On the west side passengers can reach the end of the footbridge from the footway alongside, from the slopes which pass the main line booking office and give access to the suburban booking office and from the subway from the Metropolitan station. Midway, passengers can use the footway alongside the cab road exit between Nos. 10 and 11 platforms, and can enter the station from the second Metropolitan subway. And on the east side there are entrances from Bishopsgate Street, one by a stairway direct to the circulating area, and the other by the footbridge or the booking office alongside. In addition, and most important, there are subways from both the West Side and East Side circulating areas leading to the Central London tube station below, which has escalator approaches from the Underground booking office of that line. This gives access to practically the whole of the London "tube" railway system, while the Metropolitan station brings the whole of the Metropolitan, Metropolitan District and East London lines (and by them to most of the other London termini as well as the railways in many districts) into communication. Mention may also be made of the Post Office "tube" railway, partly constructed, which has its terminus under Liverpool Street station.

Liverpool Street is a great omnibus centre, vehicles on many routes starting from or terminating immediately adjacent to the station in Liverpool Street, or passing on the Bishopsgate side. Alongside the station along Bishopsgate are blocks of offices belonging to the railway company, notably Hamilton House, where some of the offices are situated, though many sections are let to business firms. On street level are public shops. This side of the station is of red brick.

About half way along this side, with the main entrance to Hamilton House between, are archways leading respectively to the inwards and outwards yards of the Parcels Department. These yards extend across the East Side station, and continue as the luggage bridge to No. 8 platform. Hoists connect with each platform crossed, so that practically all parcels traffic can be dealt with independently of the passenger business of the station.

Last, but not least, it is necessary to refer to certain features associated with the footbridge, the circulating areas, and

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the platforms. The footbridge constitutes one of the best vantage points from which the "busy"-ness of the station can be appreciated, as it affords a means of crossing the station from side to side, having stairways at various points to enable any part to be reached. Built out from it are the very popular tea rooms. There is one of these in the East Side station, and two in the West Side station, but all are very widely used. From their windows one has magnificent views over the station, and, as the roof is lofty, well-glazed and includes artistic ironwork, the effect is very pleasing as one looks out over most of the station, watching the movements of thousands of passengers as train after train enters or leaves. Alongside the footbridge, adjacent to No. 9 platform, a large train indicator has recently been brought into use. It consists of a large casing having series of indicator windows in which are shown, on large-letter boards, the times and platforms of principal trains, stations served and notices as to the inclusion of restaurant or Pullman cars, &c. About a dozen trains can be shown simultaneously, and there is space for announcements of special trains, &c.

Although the policy at Liverpool Street has for some time been to clear away everything in the way of an obstruction to free passenger movement, for which reason seats, automatic machines, &c., are no longer provided on the suburban platforms, tobacco stalls, bookstalls, &c., are provided in convenient places. Until recently there were various small buildings behind the buffer stops of the suburban platforms, but all these have been removed. Those used by the staff have been replaced by accommodation elsewhere, while the underground lavatories, previously reached from some of these buildings, have been given entrances from other points.

Another important change is that the gates which previously controlled access to platforms individually have been set further back and replaced by rows of gates marking off inner circulating areas, one for platforms 2-6 and the other for platforms 12-18. These gates constitute continuous series, so that any or every section can be opened or closed as required. Collectors are stationed at as many as are required, but passengers can use any gate, the inner circulating area constituting a means of distribution, so that much of the old-time pressure and crowding at gates has been done away with. Behind the buffer stops of platforms 1-6 and 12-18 are pedestal train indicators which, by means of multi-sided rollers, are readily adapted to show the names of stations for any of several routes. Above are clock-face train time indicators and the final destination of the particular train. These indicators are easily visible from outside the gates. A feature of the new gates is that they have three positions, locked by a foot device—closed, open inwards or open outwards. Either of the latter positions is selected as most convenient for the unobstructed movement of passengers through the gates one way or the other. Suspended from the roof over the main line portion of the station is a large four-sided electric clock. This and other clocks about the station are governed by an electric master clock, now 25 years old, on No. 8 platform.

As regards signalling, Liverpool Street station has a standard equipment, except that route-indicating signals have now replaced the elaborate collections of semaphores which were previously required to control entrance, in view of the numbers of platforms to be served. At the London end of the old Bishopsgate station there are now two route-indicating signals for the "Up Through" and "Up Local" lines. The "Up Suburban" line has similar signals, but nearer to Liverpool Street. Approaching the platforms from the "Through" and "Local" lines "inner" route-indicating signals, near the West Box, provide further protection.

Platforms 1-7 have engine spurs for each line not conflicting with any other movement, but most of the other platforms used by suburban trains have spurs, though in some cases engines have to make shunt movements to reach them or to come back on to trains. Engine spurs in restricted locations are fitted with derailers. Several of the signals are fitted with replacers.

Necessarily, a station such as Liverpool Street entails a large staff, though the refreshment and tea rooms, &c., come directly under the Hotels and Refreshment Rooms Department, as also, of course, the hotel itself and the numerous res-

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MR. W. J. JOSLIN, M.B.E.,
Stationmaster,
Liverpool Street.

taurant cars on trains. Mr. W. J. Joslin, Stationmaster, has two Assistant Stationmasters, Messrs. A. S. J. Wightman and H. C. R. Calver, together with the following staff :—

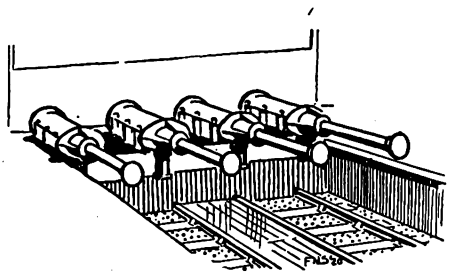
10 inspectors.
6 foremen ticket collectors.
76 ticket collectors.
21 foreman porters.
134 porters.
15 cloak-room staff.
149 other grades.

The Booking Offices are under Mr. S. Bolton, who has a staff of 30–40 persons.

The Parcels Department is under Mr. H. E. Smith, who has a staff of 236 persons, together with 80–90 cartage men working with horsed or motor road vans.

Mr. Joslin, Stationmaster, was appointed in the service of the Great Eastern Railway as a junior clerk at Seven Sisters station on March 6, 1882. He was transferred to Canning Town two years later, and in June, 1889, was appointed a District Relief Clerk. In August, 1902, he was promoted to the position of Stationmaster at Billericay, and was subsequently transferred to Liverpool Street as Assistant Stationmaster. After holding the latter position about three years, he was appointed to the position of Stationmaster at Bethnal Green. In June, 1912, Mr. Joslin was selected for the important position of Stationmaster at Liverpool Street, and succeeded Mr. M. Bedford, who was appointed Divisional Superintendent at Ipswich.

In conclusion, the writer has to acknowledge the courteous assistance of Mr. W. Clow, C.B.E., Superintendent, Southern Area, and other officers of the London and North Eastern Railway Company.



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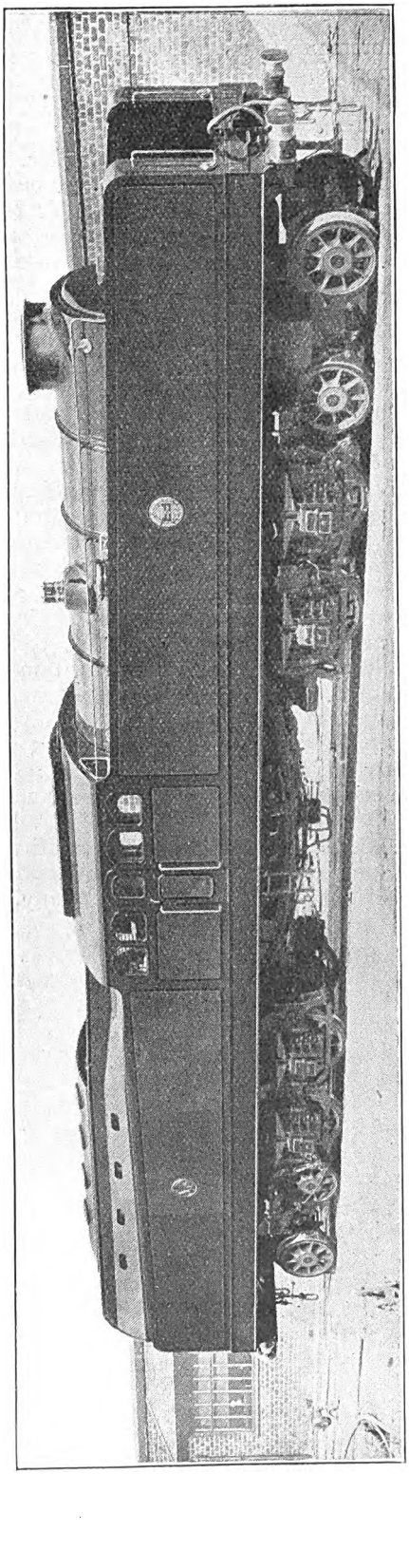

GENERAL VIEW OF "REID-MACLEOD" GEARED TURBINE CONDENSING LOCOMOTIVE.

GEARED TURBINE CONDENSING LOCOMOTIVE,

"REID-MACLEOD" SYSTEM.

THE North British Locomotive Co. Ltd., of Glasgow, has for a number of years been associated with notable experiments in regard to the application of the steam turbine for locomotive purposes, both turbine and turbo-electric.

A further stage is reached by the locomotive illustrated, constructed under the "Reid-MacLeod" patents by this firm, to whom we are indebted for the photograph. In this design geared turbines are directly applied for traction purposes. The turbines are placed longitudinally, actuating the driving wheels directly, and as coupling rods are not used, while otherwise motion is entirely rotary, practically perfect balancing is secured. The absence of reciprocating members of any kind in itself constitutes an important advantage, in that the balancing problems associated with ordinary locomotive practice are entirely avoided. This consideration is further of importance, in that the track and bridges carrying it are not subject to the running shocks associated with usual practice. This feature may also open the way for rendering heavier weights on driving wheels to be permissible.

From the traction point of view, great advantage follows from the fact that the turbine gives uniform torque, and, as a result, rapid acceleration is obtainable, equal to that which can be secured by means of electric traction. In order to enable the turbines to show their full thermal efficiency, a condenser is provided. The combination of two-stage turbines with a condenser secures expansion of the superheated steam from boiler pressure to condenser vacuum. The forced-draught apparatus ensures steady combustion in the fire-box; also that the rate of combustion is under complete control and that it can be adjusted to meet all conditions of varying load and speed. A closed system of lubrication is installed.

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Compound Locomotives.

By LORD MONKSWELL.

THE efficiency of the best steam locomotives at the present time does not appear to exceed 7 per cent.—that is to say, the power developed in the cylinders and available for driving the locomotive and train along the railway is not more than 7 per cent. of that which would be set free by the complete combustion of the fuel introduced into the firebox. There is, therefore, a very large field in which economy may be sought by improvements in the working of the locomotive from the moment the fuel is put into the firebox till the exhaust steam escapes by the chimney. Of the two stages—that of generating steam from the combustion of the fuel and that of extracting power from the steam on its passage through the cylinders—the process connected with the former is by far the more efficient. Something like two-thirds of the heat generated in the firebox passes into the water in the boiler, but of the heat in the steam only something like a tenth is converted into useful power in the cylinders. It therefore follows that there is far more scope for economies in the engine than there is in the boiler.

The most obvious ways of endeavouring to secure economy are by superheating the steam, by using some of the exhaust steam to heat the feed water and by compounding. The economies to be secured in these ways are cumulative economies—that is to say, the adoption of one does not tend greatly to diminish the good results to be expected from adopting the others as well. Superheating has shown itself to possess such great advantages that it is now the standard practice all over the world; feed-water heating is right in theory, but, owing to the fact that it does not fit in very well with the use of that simple and marvellous appliance the injector, it is not making very rapid progress. As regards compounding, its history is a history with the most bewildering vicissitudes. Different systems have at different times been adopted wholesale

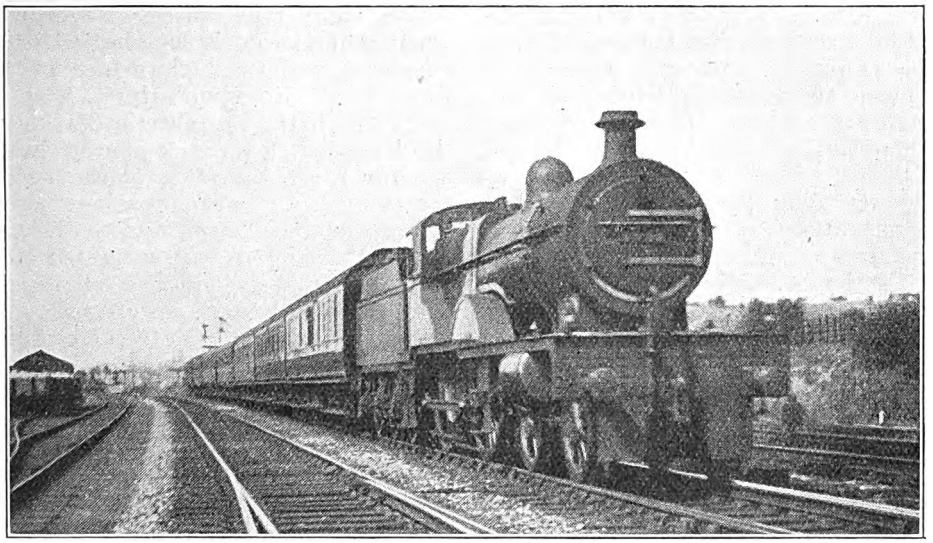

Photo.] 4-4-0 THREE-CYLINDER COMPOUND LOCOMOTIVE. [*Wm. Carter.*
Midland No. 1044 on Down Scotch Express passing Pye Bridge, L.M.S.R.

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by different companies, or even by whole countries have been standard for many years, and then have not infrequently been abandoned, while other companies and other countries have systematically refused to have anything to do with compounding.

The economy to be sought by means of compounding is that which is secured by causing the steam in the cylinders to expand to a greater extent than is practicable in the cylinders of an ordinary simple engine. There are two main difficulties in the way of increasing the expansion of the steam in the cylinders of a simple engine. One is that the valve gears usually employed do not lend themselves to such an operation. To increase expansion valve gears of a more complicated and less reliable type than those now used would have to be employed, and such very great reluctance to adopt appliances of this kind is manifest upon the railways of the whole world that it can hardly be doubted that their practical value is small.

The other difficulty is that of differences of temperature in the cylinders. The temperature of the steam in the cylinders falls as the steam expands. Moreover, steam when expanding in such a manner as to do work (as distinct from expanding without doing work, as is, for instance, the case with the steam which fills the steam-pipe, valve chest and cylinders after the regulator is opened, but before the engine begins to move) loses by the very fact of doing work an amount of energy corresponding to the amount of work which it performs. In the case of saturated steam these conditions produce condensation. The fall of temperature produced in these two ways is followed by very complicated exchanges of heat between the steam and the walls of the cylinder and of the steam passages, the practical result of which is to divert a great part of the heat in the steam from the performance of useful work to the barren task of heating up at the beginning of each stroke of the piston the cylinder walls which have been cooled by the steam just exhausted. The presence, too, of a large proportion of water vapour in the steam clogs its movements and increases the amount of power necessary for getting it into and out of the cylinder. The greater the lengths to which expansion of the steam is pushed, the greater is the difference in temperature between the incoming and exhaust steam, and the greater are the troubles and losses due to condensation, with the result that there is a definite limit to the economy which can be secured by expanding saturated steam in one cylinder. This limit appears usually to be about four volumes; that is to say, it is not usually economical to expand steam in a single cylinder to more than about four times its volume at the moment of cut-off. With superheated steam the conditions are, no doubt, somewhat different. At any rate, the clogging effect of water vapour must be much less serious, as it is only after the steam has given up so much energy as to have lost its superheat that this clogging action can take place. Nevertheless, whether the steam is superheated or not, expansion and the performance of work must lower its temperature, with the result that in this case also the first duty of the incoming steam is to give up heat to equalise the temperature of the walls of the cylinder and steam passages with its own. And the difficulty as to the valve gear is the same as with saturated steam.

In compound engines the steam is passed through two cylinders, one after the other. During the exhaust from the high-pressure cylinder, the comparatively cool escaping steam takes away with it most of the heat which during admission it had communicated to the cylinder walls, and this same heat is employed to heat up the walls of the low-pressure cylinder in very much the same way as it was in the first place used to heat up the walls of the high-pressure cylinder. In the low-pressure cylinder the expansion of the steam is still kept within the economical limits; indeed, well within these limits, as it is usually found advisable to work with a very long cut-off. The final result is that the useful expansion secured is usually nearly equal to the expansion that would be secured if the boiler steam admitted into the high-pressure cylinder were admitted direct into the low-pressure cylinder and the high-pressure cylinder were eliminated.

There are two distinct methods of arranging the path to the low-pressure cylinder of the steam exhausted from the high-pressure cylinder. One of them is the direct method known either as the "Woolf" or "Vauclain" system. In this

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arrangement the steam exhausted from the high-pressure cylinder passes directly by the shortest possible path to the low-pressure cylinder. The other is the more usual method of exhausting the steam from the high-pressure cylinder into a receiver of fairly large capacity on its way to the low-pressure cylinder. In the latter case, the equalising effect of the receiver causes the pressure during admission to be nearly constant, but in the former case the pressure on the low-pressure pistons diminishes very rapidly from the moment the piston begins its stroke, as the steam is bound to expand all the time because the space

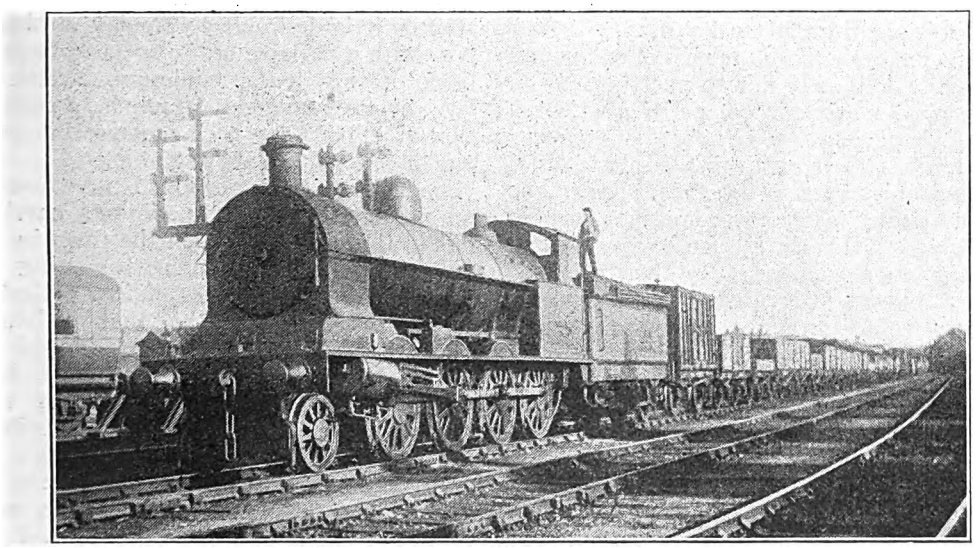

Photo.] [*J. Macartney Robbins.*

2-8-0 FOUR-CYLINDER COMPOUND LOCOMOTIVE WITH LARGE BOILER.

London and North Western Engine, No. 647, on goods train at Northampton, L.M.S.R.

which contains it is continuously and rapidly increasing.

In all compound engines it is highly desirable that the cubic contents of the low-pressure cylinder at the moment of cut-off should not be less than the cubic contents of the whole high-pressure cylinder. If this is not so, the high-pressure exhaust steam will be subjected to a process of compression that will hinder the easy passage of the steam through the cylinders.

Theoretically, there is no reason why the low-pressure cylinder of a compound engine should be different in size from the cylinder of a simple engine fitted with a boiler of the same dimensions. The addition of a high-pressure cylinder is essentially merely a means of effecting more economical working than would otherwise be possible. Actually, in compound engines, the low-pressure cylinders are usually made considerably bigger than the cylinders of a simple engine fitted with the same boiler. Another difference is that the steam pressure in the boiler is usually higher, for the very good reason that the compound design provides facilities for making the most of high-pressure steam which the simple design does not. To utilise the power of high-pressure steam it is necessary to use it in the cylinders at the nearest possible approach to its pressure in the boiler—that is to say, to run with the regulator wide open. If the pressure is reduced at the regulator, the force that might be utilised in the cylinders by expanding the steam from boiler pressure down to the pressure to which it is reduced by the throttling action of the partly opened regulator is lost, the only compensation being a very slight drying of the steam. Except that high-pressure in the boiler puts a reserve of power at the driver's disposal, the advantage to

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be secured from the use of high-pressure steam is lost if the steam is not admitted into the cylinders without avoidable reduction of pressure. With simple engines it is the rarest thing in the world to run with the regulator wide open. The driver is always apparently afraid that the big ends will heat. But with compound engines, with 227 lb. pressure in the boiler, it is the normal practice to run with the regulator wide open. This ability to utilise to the full high boiler pressures, an ability which in practice simple engines do not possess, is probably the real secret of the success achieved by suitably designed compound engines when they have been set to do exceptionally hard work.

To judge the performances of compound engines, it is only fair to put them to do the hardest work in competition with the best simple engines. Under less strenuous conditions their good qualities have little opportunity of showing themselves. The dominating idea of locomotive men in England is to avoid putting any serious strain on the engines. In their eyes the most important quality in a locomotive is the ability to go on doing only moderately hard work with absolute regularity and moderate costs for maintenance. Fuel economy is a secondary consideration, and the work that British engines are called on to do is in almost all cases so well within their powers that they have little opportunity of doing really hard work, the ability to perform which rouses practically no interest at all in the breast of the average railway officer. In fact, locomotive working in this country is for the most part a very unexciting and humdrum business. The fact that compound engines in this country have not as a rule been made to attempt to do work of superior quality is probably the most important reason for their want of success. In the rather rare circumstance of their having been made to attempt work harder than the average they seem to have scored their chief successes. Thirty years ago the old Webb three-cylinder compound *Jeanie Deans* seems to have done very well with the heaviest and fastest trains of that time, and the three-cylinder compounds on the Midland are from all accounts head and shoulders above average 4-4-0 simple engines for the purpose of working the heaviest and fastest trains.

One result of employing low-pressure cylinders larger than would be used in a simple engine with the same boiler is that with the same back pressure of the exhaust steam the loss of power is greater. To keep the back pressure down to the lowest point becomes a matter of importance. Blast-pipes with fixed orifices must always have these orifices made small enough to produce a draught sufficient in all conditions. This means that for the greater part of the time they are smaller than is necessary, and all the steam required could be produced with a larger orifice to the blast-pipe and consequently less back pressure. In these circumstances it is desirable to employ a blast-pipe with a variable orifice so as to reduce back pressure to a minimum. With a large engine running at 70 m.p.h., a reduction of 1 lb. in the back pressure is equivalent to a gain of about 33 h.p.

Bearing on this question, I have found an account of some experiments carried out in the year 1897 upon the Chemin de fer du Nord with an engine belonging to one of the earlier batches of four-cylinder compounds employed by that railway. From this it appears that at a speed of 75 m.p.h. it required about 100 h.p. less to drive the exhaust steam out of the low-pressure cylinders when the orifice of the blast-pipe presented a passage to the exhaust steam with a sectional area of 212 square centimetres than was the case when the sectional area was reduced to 135 square centimetres. (These areas correspond roughly with those offered by blast-pipes with circular orifices 6½ in. and 5¼ in. in diameter.) As the engine in question was a 4-4-0 weighing about 50 tons, it follows that with big modern engines in similar circumstances the gain due to a proportionally enlarged blast-pipe orifice should amount to 150 h.p. or more. It must be remarked that the engine on which the experiments were carried out worked, of course, with saturated steam, and, as superheated steam is much more fluid than saturated steam, the gain to be anticipated with an engine using superheated steam should be somewhat less in proportion to the power developed. But still it is likely to be considerable.

While it is an important point in the design of any kind of locomotive that the steam passages should be of ample size

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and free from sharp bends, with compound engines, in which the path of the steam is necessarily longer and more intricate than is the case with simple engines, it is much more important still. With compound engines this matter has frequently not received the attention which its importance calls for, with the result that it has been impossible to get through the cylinders all the steam which the boiler would make and the power of the engine has suffered in consequence.

In 1899 I was on the footplate of a 4-4-0 four-cylinder compound working the Nord express between Paris and St. Quentin, with a load of 140 tons behind the tender. The next year I travelled on the footplate of the first 4-4-2 engine working the same train, but with practically double the load (277 tons behind the tender). Both engines had high-pressure cylinders of the same diameter and stroke. The 4-4-2 had slightly smaller driving wheels and steam pressure higher by one kilogramme (14 lb. per sq. in.). With about the same cut-off and regulator opening the 4-4-2 with the doubled load ran along the same piece of line at the same speed as the 4-4-0 had done the year before. I was told by M. du Bousquet that the reason the 4-4-2 was able to do this was that the greatest care had been taken in designing her to arrange that all the steam passages should be of ample size and that all sharp bends in them should be avoided.

I may here say a few words upon a paragraph concerning compound locomotives which has recently appeared in the *Railway Gazette*. It begins by saying that 20 new three-cylinder compound engines are to be built at Derby, and then proceeds to state that long continuous runs are the most favourable field for compounds. This, I think, is the case not only with compounds, but with all other kinds of locomotives too. I am under the impression that frequent stops and a great deal of standing by has a deplorable effect upon the economy of any kind of locomotive. But with regard to the actual process of starting a train from rest there is some question as to the efficiency of compound locomotives, unless they are fitted with elaborate starting apparatus. I have travelled a good deal on compound express engines in England, France and Germany, and can remember serious difficulties in starting on only three occasions—once with a 4-4-0 four-cylinder P.L.M. engine, once with a 4-6-0 four-

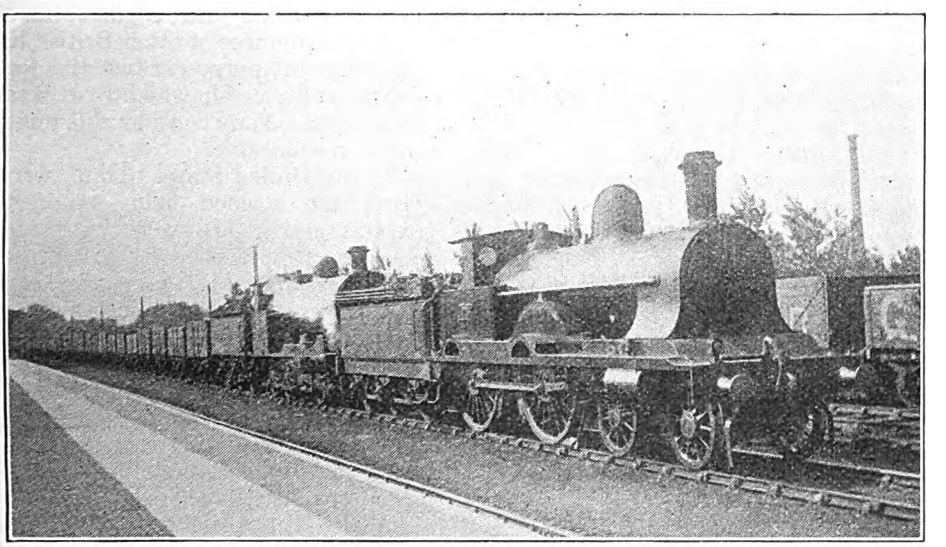

Photo.] [*J. Macartney Robbins.*

4-4-0 COMPOUND PILOTING A MINERAL TRAIN.

London and North Western 4-4-0 Compound No. 1923, "Agamemnon," and 0-8-0 superheater engines on an empty wagon train at Northampton, L.M.S.R.

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cylinder P.L.M. engine, and once with a Prussian State Railways 4-4-0 two-cylinder engine. The trouble with the P.L.M. engines was, I imagine, that the low-pressure cut-off could not be increased beyond 63 per cent. of the stroke, and so, if one low-pressure valve had just shut, the cranks were in a bad position for starting; and I suppose that there was some similar difficulty with the Prussian engine.

With regard to the question of rapidly getting into speed after a start, compounds with direct admission ot steam in unlimited quantities into the low-pressure valve chest should not be inferior to simple engines. Once, indeed, I saw the first 4¼ miles from the Gare du Nord run in 5½ min. by a 4-4-2 with 170 tons behind the tender, and, so far as I can remember, steam was not admitted direct to the low-pressure valve chests. It must be granted that this is a downhill start. The other day a Great Central Railway 4-4-2 three-cylinder compound, without direct admission to the low-pressure valve chests, hauling 150 tons behind the tender, passed Belgrave, 2¼ miles from the start at Leicester, in 4¼ min. Here the line rises at 1 in 176 most of the way. This, of course, was not nearly a record, but was by no means a bad performance.

The history of compound engines in Great Britain, the United States, France, and Germany has been very shortly, as follows:—

In England, during the 'eighties of last century, a certain number of two-cylinder compound engines were built for the Great Eastern Railway, and, subsequently, a considerable number of others were built for the North Eastern Railway. All these engines were designed by one engineer (Mr. T. W. Worsdell), who was first locomotive superintendent of the Great Eastern and then of the North Eastern Railway. His successors on both railways immediately upon taking office discontinued building compounds.

At about the same time as the two-cylinder machines were first introduced on the Great Eastern Railway, the North Western Railway began building three-cylinder compounds. About 1897 the building of three-cylinder machines was discontinued and four-cylinder designs were introduced. As on the Great Eastern and North Eastern Railways, so also on the North Western Railway, the building of compound engines ceased immediately upon the retirement of the engineer who had introduced them (Mr. Webb). The retirement of this gentleman took place about the year 1903. About 1902 the Midland began building three-cylinder compounds of a design completely different from that adopted by the North Western. A good many (about 45) of these engines were built, and from the time they were first introduced up to the present day they have done the hardest work required by the best express trains on the Midland Railway, so far as I know, with complete success.

A few compound engines have been built for a number of other British lines for experimental purposes, but the foregoing are the only cases in which British railways have acquired any considerable numbers of these machines.

In the United States about twenty-five years ago a good many engines—both express and goods—were built upon the Vauclain four-cylinder principle. The high-pressure and low-pressure cylinders on either side of the engine lay one above the other, and both piston rods worked on to a single crosshead. After receiving an extensive trial for perhaps five years, this system was abandoned. Since about 1905 some very large goods engines, mostly employed for assisting trains up long and steep banks, have been built in fair numbers on the Mallet system. The driving wheels of these engines lie in groups, one group being driven by high-pressure cylinders attached to the main frames, and the other (sometimes even the two others, as in some cases a third group of driving wheels is arranged under the tender) by low-pressure cylinders attached to articulated framing, into which this group is fitted.

Beyond this some four-cylinder balanced compounds are employed by the A.T. & S.F. Railway, which company also has some large goods engines fitted with compound tandem cylinders.

In France, the first compounds seem to have been some tandem-cylinder goods engines on the Woolf system, but by far the most important development in France, or indeed anywhere, was the adoption from about the year 1890 by one railway after another of the de Glehn compound system,

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which up till quite recently was practically everywhere employed in France for express engines and for the biggest goods engines. Just before the war the Midi partially reverted to simple engines, and since the war the position of the de Glehn compounds seems to have been seriously challenged on the ground of the lesser complication and cost of maintenance of simple engines. Apart from the de Glehn system there are a large number of two-cylinder compound goods engines of moderate power, and the Nord has a number of double-bogie goods tank engines in which one group of wheels is driven by two high-pressure cylinders and the other by two low-pressure cylinders, and also a few compound tank engines with tandem cylinders.

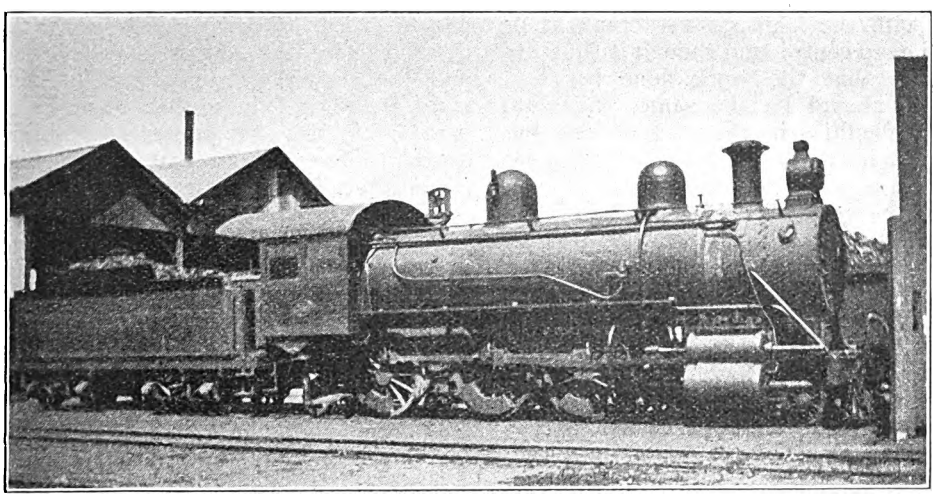

Photo.] [*E. W. Townsend.*

4-6-2 VAUCLAIN 4-CYLINDER COMPOUND LOCOMOTIVE.

Western Australian Government Railways.

In Germany, the Prussian State Railways about the year 1890 adopted the two-cylinder system for their 4-4-0 express engines and for a good number of other types besides. When superheated steam was introduced, about 1900, the two-cylinder compound system was abandoned, but concurrently with simple engines fitted with superheaters, both de Glehn and von Borries four-cylinder compounds were introduced, the principal difference between the two being that with the former the high-pressure and low-pressure cylinders drove different axles and with the latter all the cylinders drove one axle. So long as the two-cylinder superheater engines were powerful enough to work the best trains the compounds were gradually superseded, but when a greatly improved express train service was introduced some years before the war, four-cylinder superheater engines were put into service. These at first were built with simple cylinders, but shortly before the war it was recognised that compounding and superheating brought about cumulative economies, and some of the later four-cylinder engines were compounds. During the war the Germans seem to have introduced big engines with three cylinders. I understand that these machines are compounds, but I do not know anything about them.

There is thus a large choice of methods of compounding. Almost every possible arrangement of two, three, and four cylinders has been tried. Let us, as shortly as possible, consider the advantages and defects of the more important variations, beginning with the simplest, which is the two-cylinder arrangement.

In the two-cylinder arrangement the metal surfaces in and near the cylinders with which the expanding steam comes into contact are reduced to the smallest possible area in proportion to the cubic contents of the cylinders, and there should

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therefore be less loss than in any other arrangement from the abstraction of energy from the steam during admission and expansion for the purpose of heating up these metal surfaces. The number of rubbing parts and steam-tight packings, all of which give rise to a certain amount of friction, is also reduced to a minimum. In these circumstances it is to be expected that this type of compound engine will extract more power from a given weight of steam than any other, and this seems to be the case in practice. On the other hand, the reciprocating parts are much heavier than those of a simple engine of the same power; they are unsymmetrically disposed; special starting arrangements are necessary in case the engine stops with the high-pressure crank at or near a dead centre, and though it is highly desirable that the work done by each cylinder should be the same, there are great difficulties in the way of effecting this. It is, moreover, difficult to build very big engines on this system, as it is not easy to find room for a very big low-pressure cylinder.

Three-cylinder compound engines are almost, though not quite, a British monopoly. They have been constructed to two principal designs—that introduced by the North Western Railway and that introduced by the Midland Railway. In the former two small high-pressure outside cylinders placed near the centre of the frames, where the disturbances to which they gave rise had the smallest effect, drove the second pair of driving wheels and one large low-pressure cylinder placed under the smokebox drove the first pair of driving wheels. It was a design with many good points, the only serious defect being that the two sets of driving wheels were not coupled together. In an engine where the efforts exerted through the two pairs of driving wheels were liable to be very unequal this was a very bad point, as was also the liability of the two separated sets of reciprocating parts to assume positions relative to one another that made the balancing very unsatisfactory.

In the Midland three-cylinder design there is one high-pressure cylinder under the smokebox, and there are two low-pressure cylinders outside the frames, all driving the first coupled axle. Except that the reciprocating parts of large outside cylinders give rise to rather bigger disturbances than are desirable, the design of this engine is thoroughly satisfactory. She had the advantage of a boiler pressure of 220 lb. per sq. in. when working with saturated steam. The steam-pressure of the engines, which have been fitted with superheaters, has been reduced to 190 lb. per sq. in.

Of the four-cylinder designs the Vauclain has a large number of mechanical defects. Two pistons and rods and an exceptionally large crosshead all moving as one piece give rise to serious disturbances in the balancing, the crosshead itself is liable to distorting strains, as the power developed by the high-pressure cylinder varies in comparison with that developed by the low-pressure cylinder, and, both cylinders being controlled by a single valve, it is impossible to make the period of the low-pressure admission greatly different from that of the high-pressure admission as must usually be done to ensure that the engine runs freely.

This last defect alone seems to have destroyed the efficiency of the four-cylinder compounds of the North Western Railway, which in their original form were supplied with a valve gear that produced a distribution of the steam similar to that of the Vauclain compounds, though they had an intermediate receiver.

The tandem cylinder arrangement, though superior to the Vauclain in that the thrust of the piston rod comes centrally upon the crosshead, in other respects shares the defects of the Vauclain system.

The Mallet system, in which a pair of high-pressure cylinders drives one group of wheels and a pair of low-pressure cylinders another group, is, from a mechanical point of view, almost the same as a simple engine, and has no feature likely to prevent the realisation of the economies which a sound system of compounding is calculated to produce. Owing, however, to the existence of heavy reciprocating parts attached to an articulated frame, it is only suitable for slow speeds.

Finally, we come to the more elaborate of the four-cylinder systems, with automatically balanced reciprocating parts like those of the North-Western four-cylinder compounds, but with more complicated

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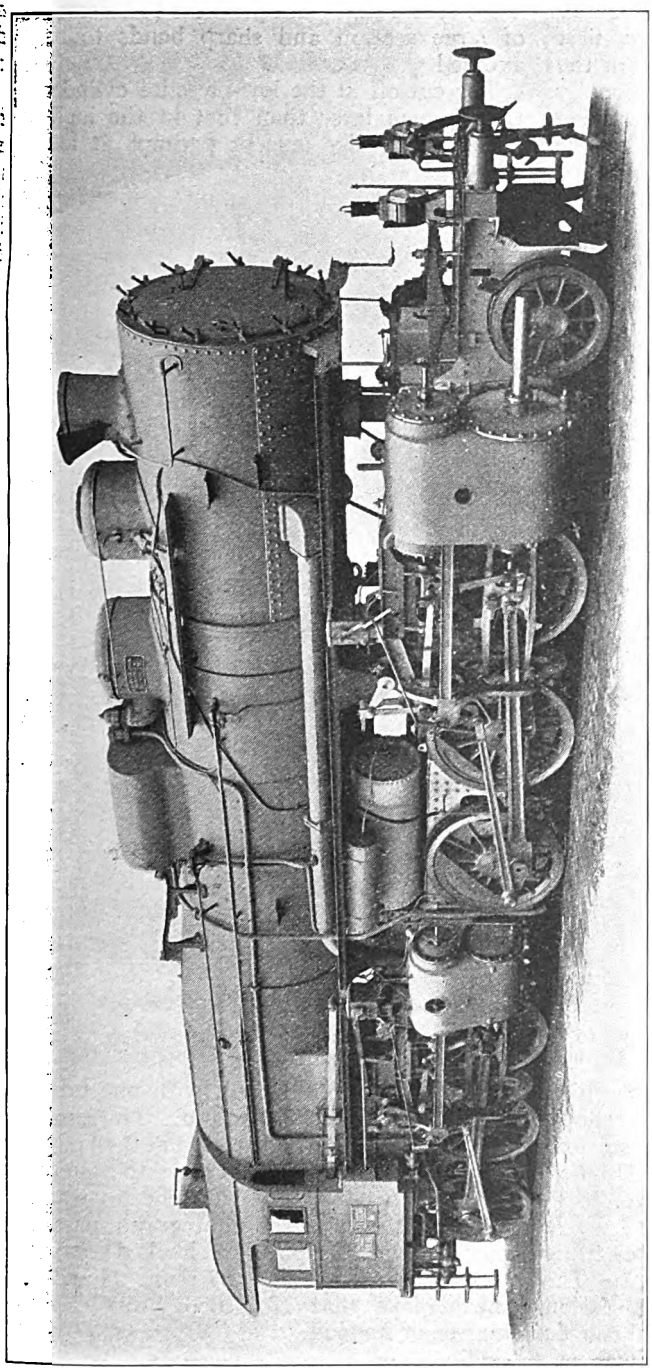
and much more efficient valve gears. One high-pressure cylinder and one low-pressure cylinder are placed on each side of the engine, with the cranks at 180 deg. from one another. The low-pressure cylinders are usually placed inside the frames so as to get their heavier reciprocating parts as near to the centre line of the engine as possible. Sometimes the high-pressure and low-pressure cylinders drive different axles, sometimes the same axle. This variation does not affect the leading principles which underlie the design of these machines. The really important point is the valve gear. No compound engine will run freely at high speeds unless the low-pressure cut-off takes place much later than the high-pressure cut-off. In some cases this result is achieved by linking the high-pressure and low-pressure valve gears together and giving the driver only one set of reversing gear to deal with, in other cases the low-pressure cut-off is fixed and the driver has only the high-pressure gear to control. The most radical solution of all, and the one which, with first-class drivers who thoroughly understand their engines, appears to produce the best results, is to fit separate valve gears to both high-pressure and low-pressure valves so that the cut-off in either pair of cylinders may be varied at will.



MALLET COMPOUND 2-6-6-0 TYPE LOCOMOTIVE.
Hungarian State Railways.

With the complete duplication of high-pressure and low-pressure motion these engines, though they do not possess any

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single organ of unusual complication, are complicated in the sense of the number of separate organs which they possess, and no doubt are more expensive to build than simple engines of the same weight. Their maintenance costs are probably smaller proportionally than their first cost on account of the sub-division of the driving stresses and the exceptionally complete counter-balancing of the moving parts, which last must also tend to reduce the maintenance costs of the road.

To resume, the essentials in the design and working of a successful compound engine appear to be as follows :—

A very high boiler pressure, the engine to be run as much as possible with the regulator wide open.

All steam pipes and passages to be made of large section and sharp bends to be avoided.

The cut-off in the low-pressure cylinder to be much later than that in the high-pressure cylinder (except perhaps at low speeds).

A blast-pipe with a variable orifice.

TEST TRAIN, L.M.S.R. (L. AND Y. SECTION).

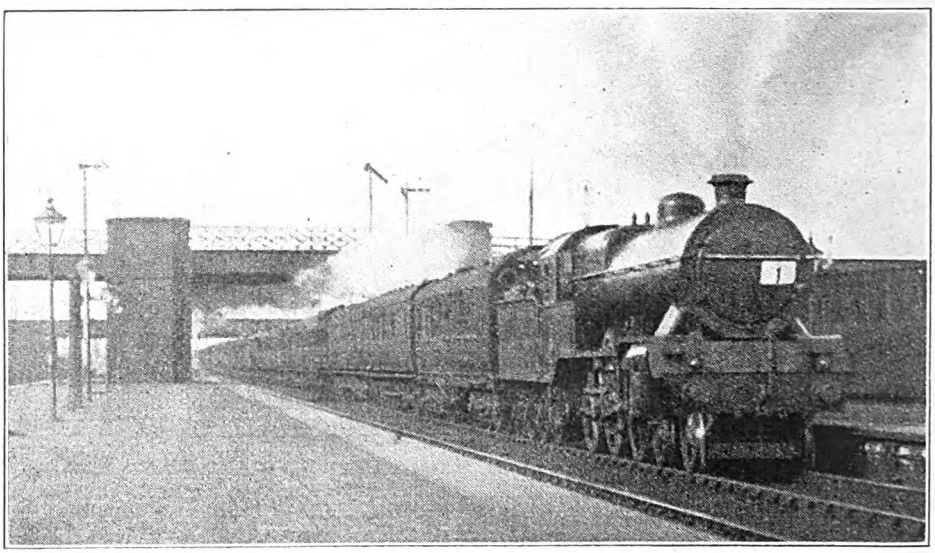

Photo.] [*R. Hogan.*

The photograph reproduced, for which we are indebted to Mr. R. Hogan, shows a special train passing Farington station. The engine used was one of Mr. Hughes' four-cylinder 4-6-0 locomotives, No. 1656, hauling a train consisting of 17 bogie coaches and dynamometer car, representing a load of approximately 500 tons. The train was booked to leave Victoria station (Manchester) at 11 a.m., and to run to Blackpool (Talbot Road), with one intermediate stop only, at Poulton. The return train left Talbot Road station at 2.40 p.m., and ran, without booked stop, to Salford. Mr. Hogan points out that the up train, which is shown in the photograph, passed Farington at 3.11 p.m., the booked passing time at Preston being 3.7 p.m. He adds the remark that No. 1656 "was easily master of its load."

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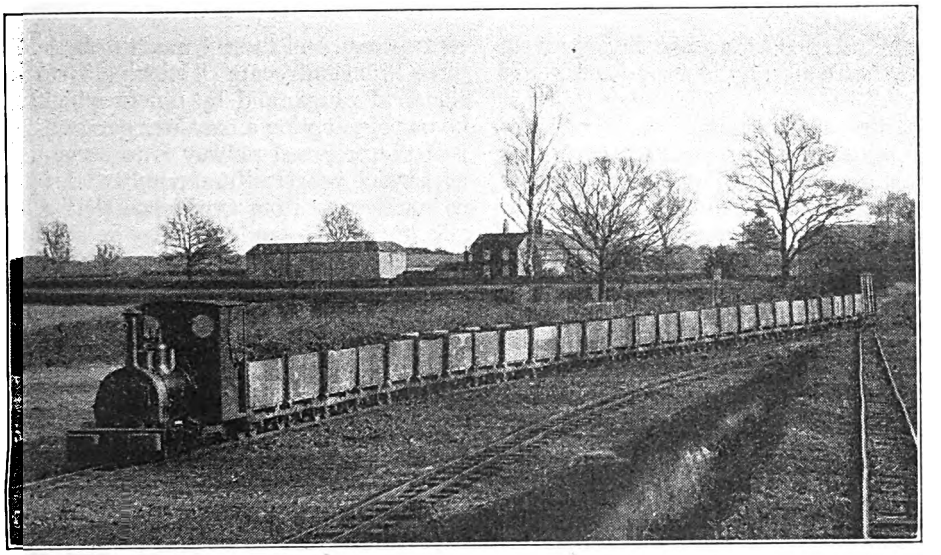

SAND HUTTON LIGHT RAILWAY.
Train entering Warthill station, where sidings are provided for exchange with L.N.E.R.

Light Railways and Agriculture.

By MAJOR SIR ROBERT J. M. WALKER, BART.

AT the present time, when politicians of all parties are professedly concerned over the deplorable state into which the agricultural industry of this country has been allowed to drift, it may not be out of place to examine what assistance could be afforded by the promotion of light railways.

In March, 1920, a strong and representative committee was appointed by the then Minister of Transport, Sir Eric Geddes, to report on the future policy and development of light railways. The terms of reference were very wide, and included the possibility of utilising roads for mechanical transport as an alternative, and a full inquiry into the methods adopted on continental light railways. The committee issued its report in July, 1921, and it is a very comprehensive document indeed. The committee went very fully into the whole question of light railways, and their conclusions form what is probably the most valuable contribution on the subject which has yet appeared.

The concluding remarks of the report may be set forth in full. The committee states: "In concluding our report, we should add that one of the broad results of our inquiry has been to confirm our impression that a new and different conception of the character and functions of a light railway is both desirable and necessary. We are convinced that existing notions with regard to the construction and operation of light railways generally are based upon experience originally gained in the construction and working of the great main lines, and that main line traditions have governed and hampered the economic development of the small undertakings.

"Light railways, in our opinion, should be regarded from quite a different angle. We think that, instead of endeavouring to maintain standards of speed and service somewhat akin to those adopted by main line undertakings, it should be recognised by all concerned that light railways are in an essentially different category and must depend for their success upon emancipation from main line conceptions of construction and operation. We are satisfied that a lower standard of speed is a first essential, and that, with the adoption of such a standard, the necessity for elaborate methods of construction and working would largely disappear, with the result that the economic position of the light

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railway industry could be radically improved, and that without any serious sacrifice of efficiency."

The writer has quoted the above remarks because, although their obvious truth has been realised for years by those seriously concerned with the promotion, construction and working of light railways, few of the general public have ever given a thought to the subject. The tendency in the past has been to sneer at any suggestion of a "light railway," even if there has not been open discouragement. The light railway built to the standard gauge of 4 ft. 8½ in. has been laughed at because it is "merely a small affair trying to imitate the great and powerful neighbours which surround it." The light railway built to a narrow gauge is laughed at "as a mere toy."

Both these judgments are, in the writer's opinion, wrong, and contrary to the facts. A little education on the subject would go far towards proving this. But to turn to the problem of the assistance which light railways can render to the agricultural industry.

In promoting the construction of a light railway, the promoters will obviously require an estimate from the farmers concerned as to the approximate tonnage, both inwards and outwards, which they will put upon the line. It is, of course, impossible to ask for a guarantee, because no farmer knows whether his traffic will be big or small for a given year. He can only be asked for a well-considered estimate, based on an average year. If the proposed railway is to be laid down in an average English agricultural district, the promoters should ask for information in regard to :—

(1) Inwards traffic—
  (*a*) Feeding stuffs.
  (*b*) Manures.
  (*c*) Coal.
(2) Outwards traffic—
  (*a*) Grain.
  (*b*) Potatoes.

Propaganda work can be carried on meanwhile and the farmer can be shown to what extent he can increase his output by utilising the new railway for the importation of manures, feeding stuffs, &c. The further the farmer is distant from his existing "main line" station, the greater he will be impressed by these arguments. Having received all the information to be obtained, the promoters must then decide on the choice of a gauge. This subject has been one of long and bitter controversy, and there is much to be said by those who advocate "sticking" to the standard gauge, and by others who are in favour of adopting a narrower gauge.

If the proposed railway is to serve a district which is agricultural purely and simply, it would seem from experience that a light railway of the standard gauge is not likely to pay as a commercial undertaking. Had it been regarded as a commercial undertaking proposition, one may well ask why the great railway company concerned did not lay a branch of its own through that particular district.

This question is, however, easily answered. The great railway company concerned knew perfectly well that any such new branch line, if laid down by it (the company), could never pay a reasonable rate of interest on the capital expenditure involved, and, moreover, it knew, as well as most of us know, that all the traffic of this particular district was bound in the long run to be brought to its own system, through either one station or another. Hence it is that farmers who have been situated at considerable distances from railway stations have been forced to pay the heavy charges incidental to cartage, whereas a light railway would have saved all the labour involved. It is true the farmer would have to pay his rates on the light railway, but if he is any sort of a farmer at all he will quickly realise how much he has to gain in the long run.

To return to the question of gauge, and supposing that the standard gauge of 4 ft. 8½ in. has been ruled out, we are then faced with the problem of which gauge to decide upon. In the writer's opinion, and he has had general experience of both categories of light railways, the smaller the gauge adopted, the better financial results are likely to be obtained.

The 3 ft. 6 in. gauge is obviously far too big to be considered for "light railway narrow gauge" purposes. It is the standard gauge of many colonial railways, including the South African, New Zealand, Queensland, and Western Australian railways, and most of these Government railways employ locomotives actually heavier than are employed on the railways in this country.

The 2 ft. 6 in. gauge is a convenient gauge, but it does not appear to have appealed to promoters in this country, there being only some 30 miles in existence.

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The curious gauge of 1 ft. 11½ in. has gained considerable popularity in Wales, both the Festiniog and Welsh Highland Railways being constructed to it.

There are two smaller public railways in Great Britain, the Sand Hutton Light and the Eskdale, both with a mileage of over seven miles. The gauge of the former is 1 ft. 6 in., whilst that of the latter is 1 ft. 3 in. Both lines are authorised to convey passengers, but only the Eskdale does so at present. On the Sand Hutton Railway, with its small gauge of 1 ft. 6 in. and fairly severe gradients of 1 in 80 for long stretches (2 furlongs, 5 furlongs, 4 furlongs, and 1 mile in length), loads of 50 tons are hauled, whilst on the level loads up to 130 tons can be dealt with. These are maximum loads, and, of course, are not often seen, a train load on the average approximating more nearly to 30-40 tons.

It may be interesting to compare the actual cost of representative types of light railways. In making such comparisons, it must not be forgotten that railways constructed before the Great War were built at a very much lower figure than those constructed since. The wages bill alone is now nearly double what it was in 1914, whilst the cost of materials, although fluctuating considerably, is still very much higher than it was in pre-war days. The conclusion come to by the committee was that in 1921 the cost of construction was in the neighbourhood of two and a half times the pre-war cost, and at the present time it may be estimated at double. It is very doubtful if any further reduction can be anticipated for several years to come.

From these figures it may be deduced that, comparing railways constructed through country of a similar nature, the examples quoted above are all in favour of the narrow gauge. It is further clearly shown how greatly the initial cost has risen both during and since the Great War. Had the Sand Hutton line, for example, been constructed before the war, the cost per mile would probably have been nearer £2,000.

Turning for one moment to Continental light railways, the following facts may be of interest. In Belgium the light railways are nearly all constructed on the 1 metre gauge. The average cost of construction in 1907 was £3,596 per mile for railways worked by steam. In France the majority of the local lines have adopted the 1 metre gauge, and most of these railways are laid alongside public roads. There is very little fencing, and gates at level crossings are only resorted to under certain circumstances. The railways run through the streets of towns like tramways, and here speed is usually limited to 10 km. per hour. In the open country, the speed restriction is usually 30 km. (or 18·6 miles) per hour. The average cost of these railways has been between £4,000 and £5,000 per mile, and in 1912 there were no less than 14,732 km. of 1 metre gauge alone in operation, in addition to a further 4,245 km. under construction or projected.

Railway.	Gauge.	Length, Miles.	Date of Opening.	Cost per Mile.	Remarks.
	ft. in.			£	
Campbletown and Machrihanish.	2 3	6	1906	4,910	Mainly "easy" agricultural country. Passenger traffic about 73 per cent. of whole.
Derwent Valley ..	4 8½	16	1913	7,566	"Easy" agricultural country. Steepest gradient 1 in 150.
East Kent	4 8½	10	1916	25,262	Rolling country. Traffic mainly coal.
Clogher Valley (Ireland).	3 0	37	1887	3,333	Wide valley. Considerable part of line laid on public roads.
Cork and Muskerry	3 0	18	1887	4,225	"Easy agricultural country."
Sand Hutton ..	1 6	7·5	1922 (part)	4,400 (approx.)	Rolling country with stretches of 1 in 80.

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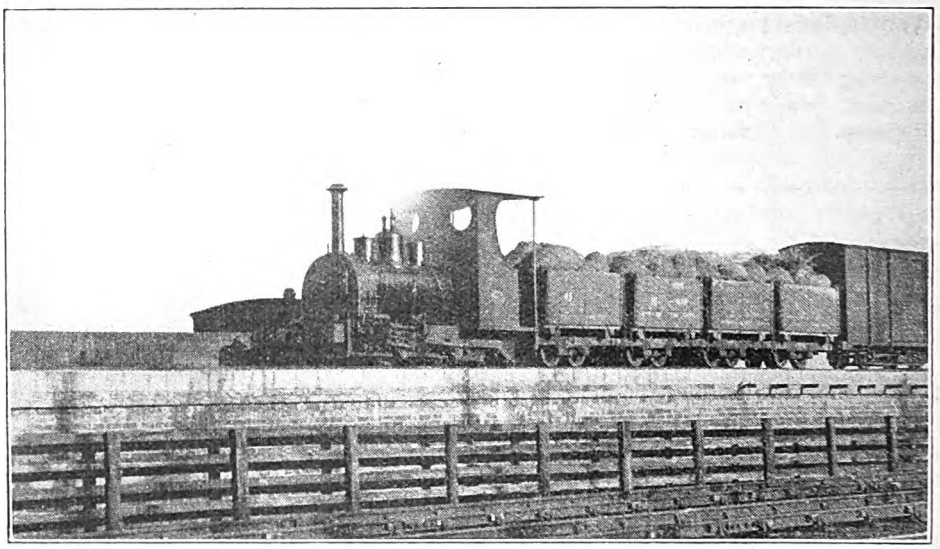
This means that as long ago as 1912 France had nearly 12,000 miles of metre gauge line alone completed or authorised. Besides this extensive metre gauge system, there were and are other railways classed as "light railways," ranging in gauge from the standard 4 ft. 8½ in. to 2 ft. In 1921 the total mileage in Great Britain and Ireland of light railways of all gauges was no more than 1,512·89, and of this total a large proportion was in Ireland.

It may be permitted once again to quote from the report of the Committee: "Broadly speaking, the policy of the French Government with regard to local railways has been one of State aid, coupled with a reservation of appreciable powers of control, whilst the more immediate control and, to a great extent, the ownership of the lines is placed in the hands of local authorities. The intervention of the State and local authorities in the construction and operation of local lines in France rests, no doubt, as it does in Belgium, upon the theory that transport is a matter of national concern, and that the indirect advantages which accrue to industry and to the population as a whole are sufficient warrant for the expenditure of public monies on the provision and working of local railways and tramways, even in cases where ordinary consideration of profit and loss would rule such projects out of court."

In Great Britain, at any rate, it has been left practically entirely to the private individual to provide light railways for specific industrial requirements, included among which is agriculture. Even in cases where there has appeared to be ample proof of the benefits which an agricultural district would derive from the construction of a light railway, projects have been allowed to fall through on account of the fear that the new line would not in itself prove a financial success.



SAND HUTTON LIGHT RAILWAY.

Potato train on unloading bank at Warthill. L.N.E.R. main line wagons can be seen behind.

One wonders whether land owners, who should be the natural promoters and supporters of these railways, ever consider the fact that the value of the land served by a good system of communication is certain to increase. One wonders, too, whether the average farmer realises the saving to him in time and labour which a light railway close to his farm must bring him.

The farmer will often argue that since he employs so many men and so many horses he may just as well send his produce to the existing main-line station, perhaps a distance of five miles there and five miles back. Many prefer to do this rather than pay the low and reasonable

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rates which most light railway companies ask. This is not sound business, but it is a point which those advocating light railways often find difficulty in overcoming. Surely in these days when agriculture is fighting for its very existence, the labour and time of every man and every horse should be utilised to the full. A man and a horse may have to take a load four miles to the station. This load of perhaps 1 ton has got to be put into the cart at the farm. It has then got to be taken over possibly narrow and indifferent roads up and downhill. The journey will take 1½ hours. The load has to be put into the railway wagon, the man has to have his dinner, and he has to return home to the farm, probably with an empty cart. By the time he gets back, a day's "work" is over, especially in the winter months. Far more likely, however, the farmer will want to put on a load of about five tons. To do this he will want five carts, five horses and two or three men. By the time this little expedition returns to the farm, it will have cost the farmer something like 30s. A light narrow gauge railway passing close to his farm will carry the whole for 15s., and tranship it free of charge at the junction station. In addition, the farmer has got a real and productive day's work put in on the farm.

Many farmers in out-of-the-way districts suffer much from delays in receiving notice from the railway station that a consignment awaits them. Thus a wagon of coal may arrive, and the following day notification will be sent by post to the farmer concerned. This will take yet another day, and it may be four days before the coal arrives at the farm. The light railway which serves an agricultural district obviates all this trouble. The coal will be on its siding the same day or the day after, and the farmer can see it with his own eyes, and very likely without going off his own farm.

It may here be useful to lay before our readers a form of procedure showing how a farmer disposes of his produce through a light railway and stating how a load of produce passes through various stages.

1. On the farmer selling his potatoes or other crop to a dealer, he informs the dealer that he wishes to rail his produce on the light railway, and that forwarding instructions should therefore be sent to the light railway office.

2. Sometimes these instructions are merely a re-sale to another dealer, but when eventually the definite forwarding orders are to hand, the farmer is immediately advised of this, and asked to arrange with the light railway foreman loader the exact date on which he would like to despatch his produce. (The light railway has, of course, to be very careful not to accept any traffic from farmers until definite forwarding instructions are received, as otherwise the produce might be held for some time before it could be cleared, with a consequent risk of damage owing to weather, &c., and also the risk of holding up trucks which would otherwise be in use.)

3. The light railway then arranges for a main line wagon and sheet at the junction, for which 24 hours' notice must be given, and also arranges to supply light railway wagons at the point required, to work in conjunction.

4. If necessary (*i.e.*, in the case of grain, &c.), the light railway arranges to obtain the necessary sacks from the main line station to be hired to the farmer.

5. On the appointed day the farmer loads his produce into the light railway wagons, fills in and hands over the light railway consignment note, and there his liability ceases.

6. The traffic is then taken over by the light railway, sheeted if necessary, hauled to a junction and transhipped into a standard gauge wagon, which has previously been shunted into the light railway sidings. The latter wagon is afterwards securely sheeted down.

7. On the day when the produce is being sent, the light railway foreman loader obtains the correct consignment note from the light railway office, hands this over to the junction stationmaster, and the main line railway takes over the wagon after it has been sheeted down and tickets it according to the light railway consignment note.

8. The truck is then ready for the evening goods "pick-up" when it arrives at the junction.

9. The light railway foreman loader enters the main line wagon number and any special remarks on the farmer's

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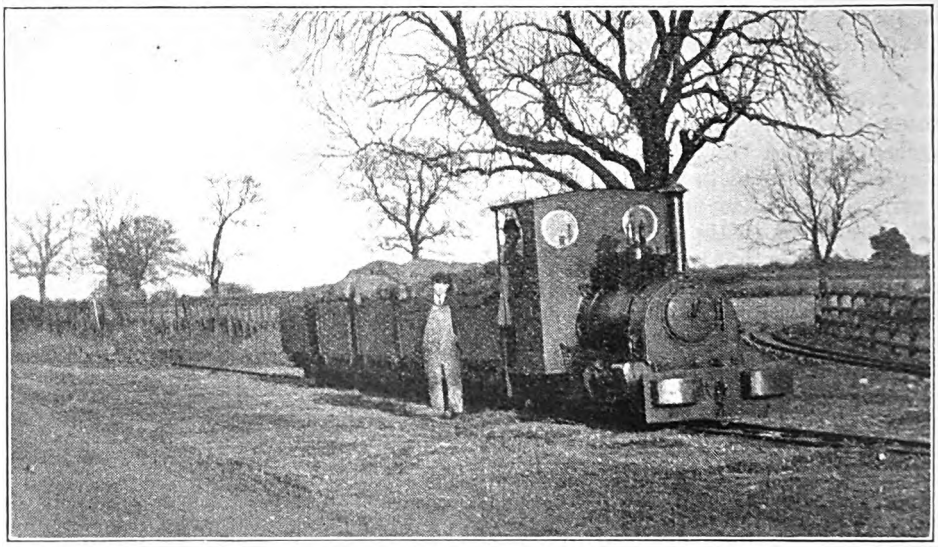

SAND HUTTON LIGHT RAILWAY.

Loading potatoes at Kinthorn's Siding.

consignment note ; this is then returned to the light railway office, and the final act in connection with consigning is for the light railway office to advise the trader that his goods have been railed according to his forwarding instructions, at the same time giving him full details as to what has been sent, also wagon number, &c. (It sometimes happens that the farmer sells direct to the place where the produce is wanted, and in this case the consignment note gives all the information necessary, as, of course, it contains in itself the forwarding instructions.)

10. With regard to accountancy, each item is entered in the light railway "Outwards" book at the junction, and charges at the appropriate rate raised by the junction stationmaster. If the consignment is carriage paid to destination, the light railway obtains its charge as a credit in the monthly settlement with the main line railway. If, as sometimes happens, the consignment is to the effect that the loader pays light railway charges, the other charges being "forward," this is noted in the "Outwards" book and a bill issued to the loader by the light railway at the end of the month accordingly.

Space does not permit of a lengthy discussion on the merits and demerits of road transport as compared with transport by light railway. Road transport has much to commend it, especially in the case of short-distance passenger traffic, since it is possible in nearly all cases to maintain a service which is practically "door to door." It is obvious that the capital outlay will be very much smaller, since road transport has its track already provided for it free of charge, and it is also equally true that a great advantage is obtained by sending goods right through direct from "door to door." In the case of goods traffic, however, this cannot always be done, and especially may this be the case in regard to the conveyance of agricultural produce. Many of the modern heavy lorries are quite unable to traverse the indifferent cart tracks leading to isolated farms, especially in winter time, and it is no uncommon sight to see a heavily laden lorry "off" even a metalled country road. Moreover, when roads are covered with ice these lorries are practically helpless without the aid of heavy studs, the use of which is now prohibited. In any case, however, the heavy lorry is not likely to be tolerated much longer on any road which has not been specially constructed or reconstructed for the

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purpose. There seems to be no moral obligation on the part of rural populations to contribute large sums of money towards the upkeep of roads ruined by motor transport services which confer no benefit whatever upon the district concerned. Again, many roads have become positively unsafe since the advent of these motor monsters. They were never intended for such purposes, since the roads were originally made narrow and with sharp and dangerous corners. It can only be possible to remedy these conditions by the expenditure of an enormous amount of public money, and even then the cost of upkeep will easily outweigh any local advantages which may be gained. In the writer's opinion the solution can only be found in the construction of agricultural light narrow gauge railways. The initial cost may be somewhat large, but the upkeep under careful and judicious management may be kept ridiculously low. The farmers' interests will be served to the best possible advantage, and the country roads and by-lanes will be kept safe for light motor-cars, horse-drawn traffic, bicyclists, and pedestrians.

A SCENE ON AN ESSEX LIGHT RAILWAY.

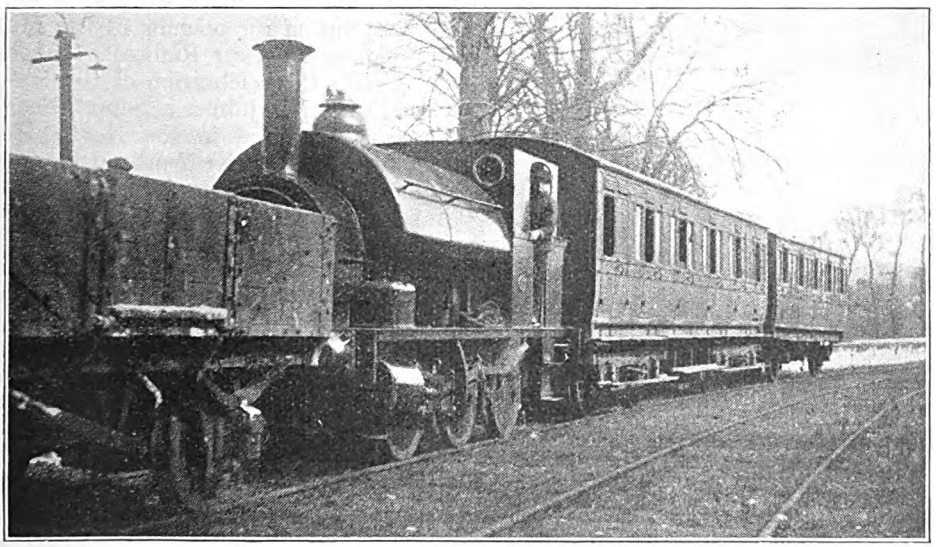

Photo.] [*L. A. Blount.*

CORRINGHAM LIGHT RAILWAY.

Train at Corringham, worked by 0–6–0 Saddle Tank Engine.

[Incorporated in 1899 and opened in 1906, this light railway, 2¾ miles in length, connects Corringham with Coryton, Essex. The company's rolling stock consists of 2 locomotive engines, 12 coaching vehicles and 2 goods vehicles.—Ed. *R.M.*]

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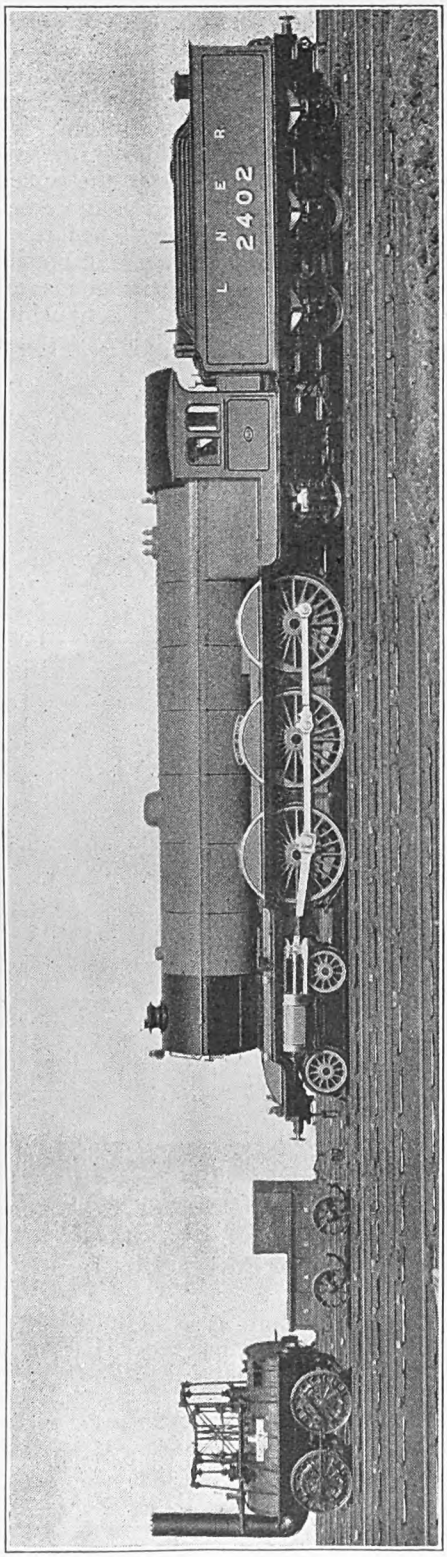

STOCKTON AND DARLINGTON "LOCOMOTION No. 1" (1825) AND L.N.E.R. No. 2402 (1924).

LOCOMOTIVES OF 1825 AND 1924.

BY the courtesy of Mr. A. C. Stamer, Chief Assistant Mechanical Engineer, London and North Eastern Railway, Darlington, we are enabled to reproduce herewith a photograph showing one of the new "Pacific" type three-cylinder locomotives, designed by Sir Vincent L. Raven, in conjunction with the old Stockton and Darlington Railway engine *Locomotion No.* 1, constructed by Messrs. Stephenson & Co. for the Stockton and Darlington line in 1825. *Locomotion* worked upon the Stockton and Darlington line from September 27, 1825, to 1841, and after its retirement from active service it was placed on a pedestal at the entrance to the North Road Station, Darlington. In April, 1892, it was removed to Bank Top station, Darlington, where it was mounted upon a pedestal on the platform. It headed the procession on the opening of the Middlesbrough and Redcar Railway. In connection with the celebration of the Stockton and Darlington jubilee in September, 1875, it was exhibited in the North Eastern Railway Locomotive Works at Darlington, among other engines, and was worked under steam supplied through a connecting pipe, the engine itself being jacked up. It was sent to the Philadelphia Exhibition of 1876, to the "Stephenson Centenary" of 1881, the Liverpool Exhibition of 1886, and the Paris Exhibition of 1889. The engine was recently taken into the Darlington shops and overhauled in readiness for the London and North Eastern Railway exhibit at Wembley.

The new "Pacific" three-cylinder locomotive is of the same design as those originally built by Sir Vincent Raven, with the exception that the trailing carrying wheels, instead of being of the radial axle-box type, are now fitted with outside bearings similar to those used by Mr. Gresley on his own "Pacific" engines. No. 2402 is fitted with an anti-vacuum valve situated behind the chimney, and is also adapted for working the vacuum brake on the train and steam brake on the engine and tender. No. 2402 has been named *City of York*. No. 2400 is now *City of Newcastle*, No. 2403 *City of Durham*, and No. 2404 *City of Ripon*.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

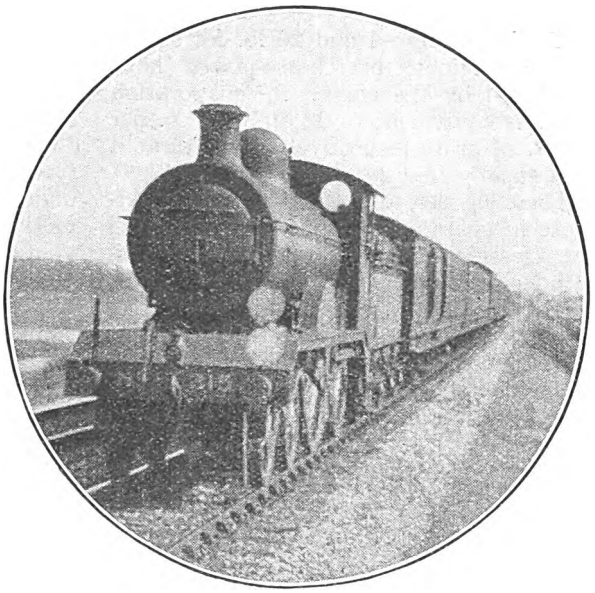

Photo.] [*E. A. Gurney-Smith.*

VICTORIA–WORTHING PULLMAN CAR EXPRESS,

Passing Bungalow Town, Southern Railway.

ONE of the most important documents connected with British locomotives that has been published for some considerable time past is that detailing the recent power classification of the locomotive stock of the London Midland and Scottish Railway Company. This classification was fully set out in the February RAILWAY MAGAZINE, and there is therefore no need to recapitulate the data then given. In so classifying the vast locomotive possessions of the grouped railways composing their system, the L.M.S. authorities have taken a valuable lead in the scientific grading of locomotive power on a combined basis of tractive effort and capacity to raise steam.

It is well known that the ordinary tractive force formula is of but limited value as an index of locomotive tractive capacity, in view of the fact that it depends alone on driving wheel and cylinder dimensions, and mean effective working steam pressure. That is to say, it assumes that, at all speeds and under all conditions, the boiler will find steam with sufficient rapidity to supply the cylinders at a constant pressure, which for working purposes in the formula is taken at some 80 or 85 per cent.—there is no absolutely definite rule—of the figure to which the boiler is pressed. But it has been proved, by exhaustive experiments conducted on the late Lancashire and Yorkshire Railway, that the mean effective pressure falls rapidly as the piston speed increases. The graph reproduced in the article referred to showed that a piston speed of 200 ft. per min. involved a drop in the mean effective pressure to 75 per cent. of the working pressure; at 400 ft. per min. the corresponding figure was 55 per cent., at 600 ft. per min. 43 per cent., at 800 ft. per min. 34 per cent., at 1,000 ft. per min. 27 per cent., and at 1,200 ft. per min. 20 per cent. of the working pressure only.

Average running speeds have, therefore, been taken into account in compiling this classification, and have been assessed at 50 m.p.h. in the case of passenger engines and 25 m.p.h. in the case of freight engines. In order to arrive at the capacity of each boiler to produce steam, a maximum combustion rate was assumed of 130 lb. of coal per sq. ft. of grate per hour, which, on the assumption of 6·15 lb. of steam evaporated per lb. of coal consumed, presupposes the evaporation of 800 lb. of steam per sq. ft. of grate per hour, as a maximum figure. Assuming, again, a steam consumption of

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25 lb. for saturated and 20 lb. for superheated engines, per horse-power hour developed by the engine, the evaporation figure is equivalent to 32 and 40 h.p. per sq. ft. of grate respectively for saturated and superheated locomotives.

These figures, obviously very approximate in character, are the basis on which the classification has been worked out, although the actual method of making the final calculations, which give the tractive effort of each type—that is, the theoretical force developed at the rim of the tyre when new, neglecting internal resistances, at the 50 m.p.h. passenger speed and the 25 m.p.h. freight speed already mentioned—is not explained. Amongst the passenger locomotives, the five classes—1, 2, 3, 4, and 5—rise in increments of ½-ton at a time from 1 to 4 tons tractive effort at 50 m.p.h. The freight engines are classified in increments of ¾-ton from 2·85 to 7·35 tons, into classes 1, 2, 3, 4, 5 and 6. The classification within each group as far as possible retains the lowest numbers for the lowest power classifications, and lower numbers within the same class for the older engines in that class, so that, as the numbers rise, power is on an ascending scale, and the newest and most powerful constructions take the highest numbers.

The work of classification has, therefore, been done with great care, and it is doubtful, indeed, whether anything so systematic in character has ever been undertaken previously in British locomotive history. At the same time I venture to share the opinion of others, with whom I have discussed the matter, that the effort to reduce the classification to the simplest possible terms has in some respects limited its usefulness. The worst blemish, in my judgment, is the exclusive assessment of passenger locomotives on a 50 m.p.h. speed rating, and of freight locomotives on a 25 m.p.h. speed rating. First of all, the rating at 50 m.p.h. of suburban tank engines with small wheels, occupied exclusively on short distance runs with frequent stops, postulates, for purposes of calculation, a speed which may never be so much as attained, and the high piston speed which thus enters into the assessment has the effect of reducing the engines concerned below what would appear to be their proportionate rating. For example, all the 0-4-4 passenger tank engines in the group, even the most powerful, are confined to Class 1.

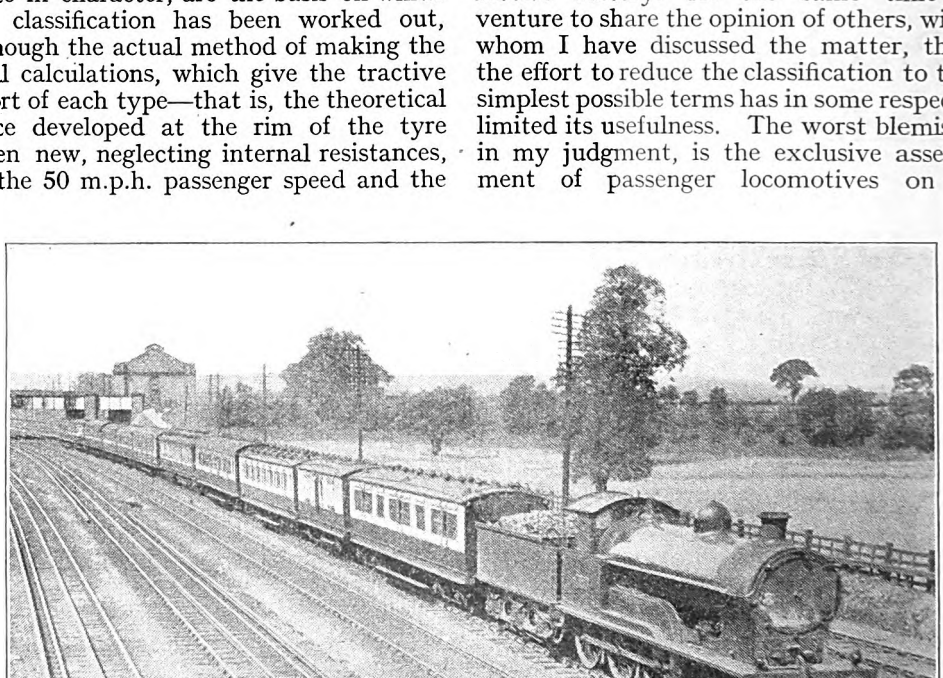

Photo.] [*F. E. Mackay.*

UP WOLVERHAMPTON AND BIRMINGHAM EXPRESS PASSING KENTON.

London and North Western 4-6-0 Locomotive, No. 1089, "Sydney Smith."

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Then, when we consider various of the main line tank engines, in whose case speed may certainly rise to 50 m.p.h. and more, although 50 may still be a high figure to represent *average* running speeds, for the same reason as that previously given, we find the large Highland 0-6-4 banking engines, the North Western "Precursor" tanks and the Midland and the North Stafford 0-6-4 tanks of the 5 ft. series as low down as Class 2, while even such heavy and powerful engines as the North Western and Caledonian superheated 4-6-2's, the Furness and Tilbury 4-6-4's, and the 5 ft. 6 in. North Stafford 0-6-4's, fail to rise above Class 3. To rate engines employed almost exclusively on banking service as goods tank engines on a 25 m.p.h. basis again seems somewhat unfortunate, the enormous Lancashire and Yorkshire 0-8-2's, for example, being found in the same class (4) as the North Western engines of the same wheel arrangement.

Again, what about engines which are very definitely of "mixed traffic" types, with smallish wheels of round about 6 ft. diameter and less? On the Western Division the 19 in. 4-6-0 engines have been treated as freight engines, and so are found in a comparatively high class (4), while on the Caledonian all the 5 ft. 9 in. and 6 ft. 4-6-0 engines, many of which are not so much as seen on a passenger train at any time, have gone into the passenger classes, and, though apparently much more powerful engines, are only classified as 3 and 4. There are many similar anomalies, arising out of the attempt to compress the whole of the locomotive stock into the two main ratings—of passenger engines at 50 m.p.h. and of freight engines at 25 m.p.h.—without any intermediate stages. Some adjustments, I understand, have had to be made already in the classification on account of such results of the calculations. What might seem more reasonable, however, would be a division somewhat as follows:—

A. Express passenger tender and tank engines, with wheels of 6 ft. 1 in. diameter on tread and over, rated at 50 m.p.h. average speed.

B. Mixed traffic tender engines, and also passenger tank engines, all with wheels 6 ft. diameter and under, rated at 35 or 30 m.p.h. average speed.

C. Tender and tank freight engines, with wheels not exceeding 5 ft. diameter, rated at 20 m.p.h.

D. Engines designed exclusively for banking service, rated at 10 m.p.h.

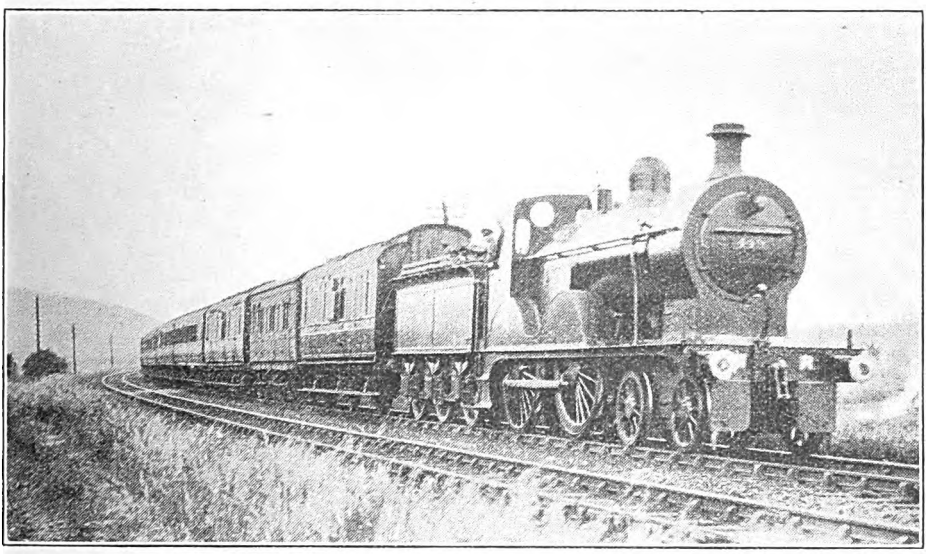

Photo.] HEYSHAM–LEEDS TRAIN NEAR SKIPTON. [*C. J. L. Romanes.*

Midland 4-4-0 Locomotive No. 449.

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Such a division would not meet every case perfectly, but I submit that it would be found, on the basis of calculation adopted, to give a more accurate estimation of available tractive power than the method actually followed.

One or two other interesting points emerge from a study of the classification. Perhaps the most striking is the way in which the large Lancashire and Yorkshire four-cylinder 4-6-0 engines rise from Class 3 to Class 5 as a result of rebuilding and superheating. The comparatively small grate area of 27 sq. ft. had a considerable influence on the former figure, no doubt, but I should imagine that the engines concerned were very near the line of division between Classes 3 and 4. As a matter of fact, I believe the five remaining saturated engines of this type, whose work is quite adequately represented by the low classification, have been altered to the "5" classification of the superheated engines, in view of early rebuilding to the very far more satisfactory pattern of the remaining engines of this type. The "George the Fifth" 4-4-0's are found in the same class (3) as the Midland Johnson 4-4-0's of the "700" series, although I fancy there would be a great difference between the performance of the two types in the haulage, say, of expresses of 360 tons and upwards over the North Western main line, and not to the advantage of the latter engines.

I am given to understand that had the Midland Lickey "banker," which on a purely tractive effort basis is the most powerful locomotive in the British Isles, been classified in figures, she would be placed in a hypothetical Class "8," representing a tractive effort between 8·10 and 8·85 tons at 25 m.p.h. It would be highly interesting to see such types as the Great Northern and North Eastern "Pacifics," and the Great Western four-cylinder 4-6-0 "Castles" and "Stars" classified on exactly the basis as the foregoing, for purposes of comparison, and I am in hopes that we may see something of the same kind done by the London & North Eastern and other locomotive authorities. Certainly, on the London & North Eastern and Great Western, special allowance for mixed traffic engines in the classification would be imperative, in view of the large extent to which they are employed on these two systems.

I will now turn to performance. First of all, by the kindness of a correspondent,

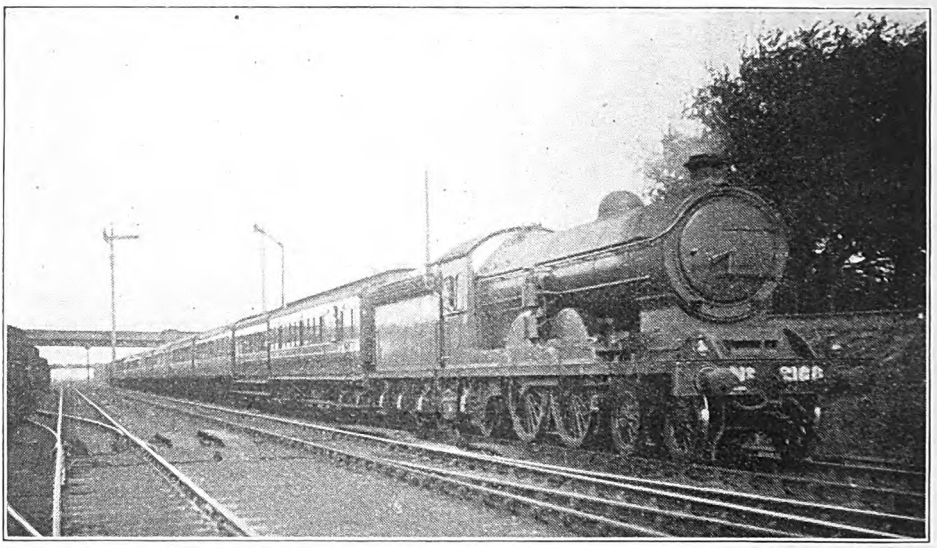

Photo.] [*Henry L. Salmon.*

NEWCASTLE-SWANSEA EXPRESS APPROACHING YORK.

North Eastern Three-cylinder 4-4-2 Locomotive No. 2168.

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I am able to give details of the running of the Midland Class "2" rebuilt 4-4-0 No. 557 on the 4.50 p.m. from Birmingham to Euston. The fact that that well-known driver, Packer of Kentish Town, was in charge on the footplate, was in itself a guarantee that the best possible was being got out of the engine. Tare load was at the modest figure of 160 tons, and gross load about 170 tons. Adderley Park was passed in 3 min. 15 sec., Stechford in 5 min. 22 sec., Marston Green in 7 min. 57 sec., Hampton in 11 min. 17 sec., Berkswell in 14 min. 35 sec., Tile Hill in 16 min. 30 sec., and Coventry in 19 min. 35 sec. Speed rose to 68 m.p.h. near Hampton, fell to 58 at Berkswell Tunnel, and 75 was touched momentarily at Coventry, prior to a bad signal check at Ballast Pit Box; after that the rate just recovered to 60 before Rugby, which was passed in 31 min. 45 sec. from the start, at 37 m.p.h.

Accelerating to 52 m.p.h. before entering Kilsby Tunnel, No. 557 passed Welton in 40 min. 30 sec., Weedon in 45 min. 25 sec., at 72 m.p.h., Blisworth in 51 min. 28 sec., Roade in 54 min. 15 sec., at 60 m.p.h., Castlethorpe in 58 min. 35 sec., after a maximum of 74, Wolverton in 60 min. 37 sec., Bletchley in 65 min. 52 sec., at 64, Leighton in 72 min. 4 sec., at 61, Cheddington in 76 min. 7 sec., at 57, and Tring in 80 min. 58 sec., at 52 m.p.h. minimum. The descent to Willesden was taken easily, with no higher speed than 70 m.p.h. to King's Langley, and a slack to 35 in Watford Tunnel; so Watford was passed in 94 min. 47 sec., and Willesden was reached in 107 min. 45 sec., $1\frac{1}{4}$ min. early. Net time for the 107·5 miles was about 105 min., start-to-stop, and this could have been cut to 104 min. or so with faster running from Tring. The engine did faster work than I should have expected, although the load—four corridor bogies and a "diner"—was very light, even by Midland standards.

Before I leave the L.M.S. Birmingham service, I must mention one or two runs which I have had since writing last month's article. In the first of them the 9.10 a.m. out of Euston was made up, on a Monday, to a considerably heavier formation than previously of 38 axles, 228 tons empty and 250 tons full, as the train was packed. By the way, I notice among last month's "Why and Wherefore" replies the statement that "some of the two-hour trains to and from Euston load up to considerable weights." I should be interested to hear which are the "some" referred to—that is, unless 250 tons, which represents quite a maximum in all ordinary conditions on this service, is regarded as a "considerable weight." Even the popular 6.55 p.m. down is no heavier than this, although the complementary 8.40 a.m. up from Birmingham does occasionally exceed this loading on Mondays. But my description of the Birmingham service by this route would be that the majority of the expresses are of light formation, and that a few—a round half-dozen all told—carry moderate or moderately heavy loads. If 250 tons were a "considerable weight," how should we find words to describe, say, the 5.45 p.m. out of King's Cross?

To resume, on the 250-ton 9.10 a.m. down, with superheated "Precursor" No. 127, *Snake*, at the head of the train, from Willesden we passed Harrow in 8 min. 20 sec., at 55 m.p.h., attained 57 beyond Hatch End, on the 1 in 330, and got through Watford in $14\frac{1}{2}$ min., at 66 m.p.h. Up the remainder of the 1 in 330 we were still doing 60 at Boxmoor, passed in 21 min. 25 sec., and passed Tring in $28\frac{3}{4}$ min., having fallen to a steady $58\frac{1}{2}$ m.p.h.—really first-class work for a 60-ton 4-4-0 with 250 tons on a grade of 1 in 330. We just touched $80\frac{1}{2}$ m.p.h. below Cheddington, and well sustained 79 for a long distance, running from Tring to Bletchley in $12\frac{1}{2}$ min., and on to Wolverton in exactly 5 min. more. Speed varied between $72\frac{1}{2}$ m.p.h. at Leighton and Wolverton to 67 beyond Bletchley, and we passed Castlethorpe, 49·4 miles from Willesden, in 48 min. 25 sec. Minimum speed at Roade, passed in 53 min. 20 sec., was 60 m.p.h., and Blisworth was passed in 56 min. 5 sec., at 66 m.p.h. After this the engine was eased very slightly, the times being 62 min. 25 sec. to Weedon, 67 min. 55 sec. to Welton, and 75 min. 5 sec. to Rugby, with a minimum of 60 on the ascent to Kilsby, and a maximum of 65 beyond. After this, unfortunately, we suffered signal checks all the way to Birmingham and arrived late.

On the 6.55 p.m. out of Euston, with a

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train of four corridor eight-wheelers and three dining cars, weighing also 250 tons all found, No. 1706, *Elkhound*, of the "George the Fifth" class, displayed precisely the same ability to maintain speeds ranging round about the mile-a-minute rate continuously up grades of 1 in 330. An excellent start was first made up Camden bank, Willesden being passed in the fine time of 8 min. 50 sec., at 57½ m.p.h., and we then accelerated up the 1 in 330 to 60 from Wembley to Harrow, and as much as 61 at Hatch End. At Watford our maximum speed was 66 m.p.h., falling gradually up the in 62¾ min., Weedon in 73 min. 5 sec., Rugby in 86 min. 50 sec., Coventry in 97 min. 40 sec. (having attained 69 m.p.h. at Brandon), Stechford in 112 min. 55 sec., and reached Birmingham in 118½ min. from Euston.

On the 1.15 p.m. down, with a 26-axle train of 200 tons, 4-4-0 No. 5394 (new numbering), *Phaeton*, had a simple task. Once again we passed Willesden in 8 min. 50 sec., and with maintained speeds of 57½ m.p.h. at both Hatch End and through and beyond Berkhamsted passed Watford in 21¼ min., at 66 m.p.h., and Tring in 35 min. 20 sec. Maximum speed near

Photo.] **BIRMINGHAM EXPRESS PASSING BRENTHAM HALT.** [*A. T. Daines.*
G.W.R. 4-4-0 Locomotive, No. 3810, "County Wicklow."

subsequent 1 in 330 to 61 at King's Langley, 60 at Boxmoor, 59 at Berkhamsted, and 58½ at Tring—another remarkable piece of work for a locomotive drawing nearly five times her own weight. So we passed Harrow in 14 min. 55 sec., Watford in 20 min. 50 sec., Boxmoor in 27¾ min., and Tring in 35 min. 5 sec. We touched 74 m.p.h. at Cheddington, and were still doing 70½ at Leighton; but about Bletchley, passed in 48 min. 40 sec. from the start, the engine was eased, and as this train has no intermediate stops within the two-hour schedule there was nothing further of material interest about the run. We passed Roade Cheddington was 77½ m.p.h., after which speed ranged between 71½ at Leighton, 66 at Bletchley, 68 at Wolverton, 53½ at Roade, 66 at Weedon, 55 at Kilsby, and 70½ at Clifton Road, before Rugby slack, giving times of 61 min. 25 sec. to Roade, 70 min. 50 sec. to Weedon, 76¾ min. to Welton, and 84 min. 55 sec. to Rugby, passed at 38 m.p.h. Not exceeding 65 m.p.h. between there and Coventry, we stopped at the latter station in 96 min. 35 sec. from Euston. Re-starting, we accelerated to 50 m.p.h. up the 1 in 330 to Berkswell Tunnel, touched 76½ m.p.h. on the corresponding descent to Hampton, and reached Birmingham in 22 min.

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exactly. Berkswell, 5·5 miles, was passed in 8 min. 50 sec., and 11·5 miles thence to Adderley Park were reeled off in 10 min. 10 sec.

In the last issue and this I have given a series of five down runs on this service, which are consecutive runs without omissions, timed during the course of rather under two months. It will be apparent from these details that not only is consistently fine work being performed, but that, in respect of both uphill and downhill speeds, the "George the Fifth" performance is on a level even higher than that which obtained before the war, when there were no trains booked to make an intermediate stop within the two-hour schedule. From four of these runs alone I have compiled the table of minimum

LONDON MIDLAND & SCOTTISH RAILWAY.

Summary of Minimum Times: Euston—Birmingham.

Distance.	Stations.	Times.	Speed.	Run
Mls. C.		M. S.	M.p.h.	No.
0 00	Euston	0 00	¶	—
5 30	Willesden	8 50	57½	4
8 06	Wembley	11 35	60	4
11 31	Harrow	14 55	60	4
13 24	Hatch End ..	16 45	61	2, 4
15 78	Bushey	19 20		2
17 37	Watford	20 40	70½	2, 4
20 75	King's Langley ..	23 50	66	2
24 41	Boxmoor	27 00	65	2
27 78	Berkhamsted ..	30 15	62½	2
31 56	Tring	33 55	62½	2
36 09	Cheddington ..	37 35	83½	2
40 18	Leighton	40 35	80½	2
46 55	Bletchley	45 30	79	2
52 35	Wolverton	49 55	80½	2
54 61	Castlethorpe ..	51 45	75	2
59 72	Roade	56 40	60	3
62 67	Blisworth	59 25	66	3
69 58	Weedon	65 35	70½	1
75 22	Welton	70 55	61½	1
82 44	Rugby*	78 05	57*	3
83 17	Rugby No. 7 ..	78 55	57	3
89 06	Brandon	84 30	69	4
93 77	Coventry	88 55	60	2, 4
97 41	Tile Hill	92 40	56½	2
99 38	Berkswell	94 40	—	2
102 66	Hampton	97 40	74	2
106 30	Marston Green ..	100 40	—	2
109 10	Stechford	103 00	—	2
111 00	Adderley Park ..	104 45	—	2
112 71	New Street ..	107†45	—	—

¶ Chronograph speeds corresponding to point-to-point times.
* Service slacks.
† *Net* time, Adderley Park—New Street.

times here shown, No. 1 being the trip with *Australia* in the last issue, hauling 195 tons; No. 2 the remarkable performance of *Titan* with 190 tons; No. 3 the effort of *Snake* just described; and No. 4 that of *Elkhound* on the 6.55 p.m., which gives the necessary non-stopping time past Willesden not obtainable from the 9.10 a.m. runs. It is remarkable that from these four runs only we get an aggregate "fastest" time of 107¾ min. for the 112·9 miles from Euston to Birmingham, and this despite the fact that not one of the engines was being worked really hard during the last part of the journey.

In conclusion, it is quite logical that I should follow on with a few more runs on the competing Great Western service. These may be taken as a preliminary to a further instalment of Great Western runs in other directions; I am more particularly anxious to deal with these runs in the present article, as the exceptional features out of four of them again dovetail to give a remarkable aggregate time of under 106 min. from Paddington to Snow Hill. Of the five tabulated down runs, two were on the 9.10 a.m. express, which makes a one-minute stop at High Wycombe, and subsequently sheds portions of its load by successive slips at Bicester, Banbury and Leamington; two on the 12.50 p.m., with a three-minute halt at Leamington, and no slip portions; and one on the 10.40 a.m. down non-stop. The engines in all five cases were of the four-cylinder 4-6-0 type, and on the two 12.50 p.m. runs of the penultimate "Abbey" class. Out of London, on the 9.10 and 10.40, we took some substantial loads as far as Bicester, surpassing the heaviest noted on the rival route in the runs already described.

The chief feature of the first run was brilliant running out to Risborough; we slacked to 38 m.p.h. at Old Oak Common West, but between there and Ruislip troughs—a 10-mile stretch which includes 3¾ miles up at 1 in 225-264, 1¾ miles at easier grades, 2½ miles level, and only 2 miles downhill in widely-separated strips—*Knight Commander* got up to 70½ m.p.h., and followed this up with the startling feat of maintaining a minimum of exactly 60 m.p.h. right up 7½ miles, first at 1 in 225-175 and then at 1 in 264, with nearly 300 tons, be it remembered, to

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Beaconsfield. Then, after re-starting from Wycombe, we attained and maintained the notable speed of 55 m.p.h. up the 6¼-mile bank past Saunderton, of which the upper 3¼ miles are exclusively at 1 in 164. After at a minimum rate of 64 m.p.h. ! This was, of course, with a load reduced to 250 tons from Bicester onwards. Once again we eased very markedly, slacking to no more than 45 m.p.h. over Aynho

G.W.R. PADDINGTON—BIRMINGHAM.

Distance.	Run No.	Schedule.	1.	2.	Distance.	Schedule.	3.	4.	Schedule.	5.
	Four-cylinder 4-6-0 No.		4020(*a*)	4052(*b*)			4070(*c*)	4068(*d*)		4043(*e*)
	Gross Load in Tons. To Bicester.		280	290						
	" Banbury.		250	255			190	235		320
	" Leamington.		220	225						
	" Birmingham.		190	195						285
Miles.		min.	m. s.	m. s.	miles.	min.	m. s.	m. s.	min.	m. s.
0·0	Paddington..	0	0 0	0 0	0·0	0	0 0	0 0	0	0 0
3·3	Old Oak Common West Jc.¶	6	6 20	6 15	3·3	6	6 0	6 45	6	6 45
7·8	Greenford	11	11 40	11 55	7·8	11	11 40	12 20	11	13 5
10·3	Northolt Jc.	13½	14 10	14 40	10·3	13½	14 0	14 35	13½	15 50
14·8	Denham	—	18 20	19 30	14·8	—	18 0	18 30	—	20 30
17·4	Gerrard's Cross	—	20 50	22 40	17·4	—	20 25	20 50	—	23 30
21·7	Beaconsfield	—	25 10	27 55	21·7	—	24 40	24 50	—	28 40
26·5	High Wycombe¶	31	30 15	32 55	26·5	30	29 5	29 20	30	33 25
				sigs.						
2·3	West Wycombe	—	4 20	5 50	28·8	—	32 5	32 45	—	36 35
							sigs.			
5·0	Saunderton..	—	7 20	10 50	31·5	—	35 40	36 10	—	40 20
							sigs.	sigs.		
8·2	Princes Risborough ..	10	10 40	14 30	34·7	39	41 5	40 5	40	44 0
13·6	Haddenham	—	15 30	18 45	40·1	—	45 10	44 35	—	48 10
17·7	Ashendon Jc.§	19	19 10	21 55	44·2	48	48 10	48 20	50	51 25
20·9	Brill	—	22 35	24 45	47·4	—	51 20	52 5	—	54 55
23·9	Blackthorn	—	25 0	27 10	50·4	—	53 55	54 35	—	57 35
26·9	Bicester	28	27 30	29 40	53·4	57	56 30	57 0	—	60 5
30·7	Ardley	—	31 10	33 30	57·2	—	60 35	60 35	—	64 15
35·9	Aynho Jc.§..	37	36 15	38 25	62·4	66	65 45	65 0	69	69 45
41·0	Banbury	42	41 55	43 0	67·5	71	70 30	70 30	74	74 40
44·6	Cropredy	—	45 55	46 25	71·1	—	74 0	74 25	—	78 10
49·7	Fenny Compton	—	51 0	51 20	76·2	—	79 5	79 30	—	83 20
54·7	Southam Road	—	55 0	55 25	81·2	—	83 10	84 10	—	87 30
60·8	Leamington¶	62	61 5	61 0	87·3	91	89 50	90 45	94	93 0
62·8	Warwick	—	63 40	63 5	2·0	—	3 15	3 15	—	95 25
67·0	Hatton	—	68 15	68 0	6·2	—	8 30	8 10	—	100 45
71·2	Lapworth	—	72 20	72 30	10·4	—	12 45	12 10	—	105 35
73·7	Knowle	—	74 45	75 30	12 9	—	15 10	14 35	—	108 15
77·1	Solihull	—	77 50	78 50	16·3	—	18 15	17 40	—	111 35
80·9	Tyseley	—	80 50	82 0	20·1	—	21 15	20 40	115	115 0
							sigs.			sigs.
84·1	Snow Hill	88	84 50	86 20	23·3	26	25 40	24 30	120	120 15
110·6	Net times (min.)*	117	113½	114	110·6	115	110¼	112¼	120	119

* On non-stopping basis. ¶ Severe service slacks. § Slight service slacks.
(*a*) "Knight Commander." (*b*) "Princess Beatrice." (*c*) "Neath Abbey."
(*d*) "Llanthony Abbey." (*e*) "Prince Henry."

that followed very easy running to Ashendon, with a slack to 60 over the junction, but we did well beyond, attaining 77½ m.p.h. on the 3-mile descent at 1 in 200 from Brill, and going right up 6 miles at the same inclination to Ardley Junction, and, except for a maximum of 76½ m.p.h. before Southam Road, nothing more of note was done till we were through Leamington. Then came a wonderful ascent of Hatton bank, with a minimum of 51 m.p.h. (with 190 tons) on 2½ miles at

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1 in 104—there are really 3¾ miles at this inclination within the complete bank of 6 miles, but the incline is broken with easier strips—and we followed with some tremendous speed on the easy, but generally favourable subsequent length to Snow Hill, touching 70½ m.p.h. at Lapworth troughs, and 77½ before Tyseley.

The next run commenced with a particularly leisurely start to Wycombe, wherein we lost nearly 2 min., and ¾-min. overtime there, with fully 3 min. more lost by a signal check which almost stopped us at West Wycombe, made us some 6 min. late through Risborough. Then the driver of *Princess Beatrice* threw restraint to the winds, and we achieved the remarkable time of 44 min. 35 sec. over the 50·9 miles from Risborough to mile-post 104¼ (Leamington, via Oxford), which works out at an average rate of 68·5 m.p.h. We touched 83½ m.p.h. before Haddenham, and, after a momentary fall to 77½, 80½ before Ashendon, which was negotiated at a higher speed than usual; after a minimum of 68 at Brill, we touched 80½ again at Blackthorn, only fell to 59 at Ardley Summit, and then went easily down to Aynho, with a maximum of 68 m.p.h. We eased very slightly over the junction, and then maintained round about 68 an hour past Banbury and Cropredy, to a minimum of 61½ at Fenny Compton, after which we kept up between 76½ and 77½ to Southam Road, and finally reached 80½ a fourth time before slowing for Leamington. Leamington was also passed at a higher rate than usual, but from there the work fell off somewhat; Hatton bank brought us down to 45 m.p.h., and we reached Birmingham a minute late, which loss, however, was considerably more than offset by the West Wycombe delay.

Both the runs on the 12.50 p.m. down afforded brilliant starts. Speeds over Old Oak Common West Junction were in both cases 20 m.p.h. and at Greenford 66; after that 70½ and 72½ m.p.h. at Ruislip troughs, 60 and 64 at Beaconsfield (the last-named another amazing summit figure with a 235-ton train), and 75 and 77½ before Wycombe, where slacks were made to 40 and 35 m.p.h. *Neath Abbey* had accelerated to 51 and *Llanthony Abbey* to 53½ m.p.h. up Saunderton bank, when both trains were badly checked by signal, *Neath Abbey* being all but stopped. But the latter compensated for this delay by attaining 85 m.p.h. below Risborough, whereas *Llanthony Abbey* was content with 77½, and, furthermore, lost time by easing to 48 m.p.h. at Ashendon without so much as touching the brakes. Tremendous accelerations from Ashendon produced speeds of 75 and 79 m.p.h. at Blackthorn, and the minima at Ardley were 55 and 62½ m.p.h.—once again a wonderful figure in the latter case. *Llanthony Abbey* also touched 75 an hour between Ardley and slacking for Aynho,

GREAT WESTERN RAILWAY.

Summary of Minimum Times: Paddington—Birmingham.

Distance.	Stations.	Times.	Speed.	Run
Mls. C.		M. S.	M.p.h.	No.
0 00	Paddington ..	0 00	¶	—
1 20	Westbourne Park ..	3 05	—	2, 3
3 22	Old Oak Common West Jc.*	6 00	41*	3
4 46	Park Royal ..	7 50		1, 2
7 64	Greenford	11 15	66	4
10 22	Northolt Jc. ..	13 30		4
12 07	Ruislip	15 05	72½	4
14 64	Denham	17 25		4
17 34	Gerrard's Cross ..	19 45	64½	4
21 55	Beaconsfield ..	23 45	64½	4
			77½	4
26 44	High Wycombe* ..	28 10	40*	3
28 63	West Wycombe ..	31 00		3
31 42	Saunderton.. ..	34 20	55	1
34 54	Princes Risborough	37 40		1
40 07	Haddenham ..	41 45	85	3
44 19	Ashendon Jc.* ..	44 45	60*	3
47 35	Brill	47 35	68	2
50 34	Blackthorn ..	50 00	80½	2
53 31	Bicester	52 25	67	4
57 16	Ardley	56 00	64	4
61 43	Aynho Park ..	59 35	75	4
62 33	Aynho Junc.* ..	60 25	60*	4
63 77	King's Sutton ..	61 55	68	2
67 38	Banbury	65 00	68	2
71 09	Cropredy	68 25		2
76 20	Fenny Compton ..	73 20	61½	2
81 17	Southam Road ..	77 20	77½	1
85 52	Mile-post 104¼ ..	81 00	80½	2
87 28	Leamington* ..	82 55	45*	2
89 24	Warwick	85 00	60	2
93 36	Hatton	89 35	51	1
97 56	Lapworth	93 35	70½	4
100 20	Knowle	96 00		1, 4
103 53	Solihull	99 05	77½	1, 4
107 27	Tyseley	102 05		1, 4
109 36	Bordesley	104 05		1, 4
110 47	Snow Hill	105 55		4

* Service slacks. ¶ Chronograph speeds corresponding to point-to-point times.

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but *Neath Abbey* was more restrained; and both engines were so well on time that no further effort worth mention was needed to Leamington. After leaving Leamington, the two engines both accelerated to 53½ m.p.h. in 2 miles to Warwick, both passing that station in the astonishing time of 3¼ min.; and then *Llanthony Abbey* succeeded in lifting her 235-ton train up the 1 in 104 of Hatton bank without any lower speed than 50 m.p.h.! Very high speeds followed to Birmingham, *Llanthony Abbey* reaching 75 m.p.h. beyond Solihull and *Neath Abbey* as much as 77½ m.p.h., on grades but little easier than level. Net running times, on a non-stop basis, were well below the equivalent time of 115 min. scheduled (allowing 2 min. for stopping at and starting from Leamington); indeed, the net time of *Llanthony Abbey* was but little over 110 min.

Apart from load, the only feature of note about *Prince Henry*'s run on the non-stop 10.40 a.m. down was the fast running between Risborough and Leamington. We reached 86½ m.p.h. at Haddenham and 74 at Brill, maintained 76½ between Fenny Compton and Southam Road and touched 80½ below the latter station, while the minima were 50½ at Ardley and 57½ at Fenny Compton. On this occasion I continued through on the non-stop run to Chester with the same engine and a featherweight load of 150 tons only, but we were cruelly checked with bad permanent way checks at Swan Village (10 m.p.h.), Albrighton (twice to 20) and Wrexham (20), and signals below Oakengates (30), in addition to the usual service slacks to 50 m.p.h. at Wednesbury, 40 at Priestfield, 25 through Wolverhampton and Dunstall Park, 47 at Wellington, 10 through Shrewsbury, 35 at Ruabon, 40 at Gresford and 30 at Saltney Junction. How any engine could be expected to maintain an overall speed of 53·4 m.p.h. in such distressing conditions is not clear, but in point of fact we lost only 4 min. 35 sec. on the 95 min. allowance. The chief actual passing times were 18 min. 10 sec. to Wolverhampton, 41 min. 10 sec. to Wellington, 52 min. 5 sec. to Shrewsbury, 71 min. to Gobowen, 79 min. 5 sec. to Ruabon, and 85 min. 5 sec. to Wrexham. Chief speeds were 67 m.p.h. at Codsal, 66 before Shifnal (after Albrighton check), 53 minimum at Hollinswood (after 5 miles up at 1 in 150—a fine figure), 71½ before the check at Oakengates, 70½ below Wellington, 75 twice between Shrewsbury and Gobowen (18 min. 55 sec. for the 18 miles from Shrewsbury to Gobowen was the fastest part of the journey), and 70½ at Rossett. Over such a route the 95-minute

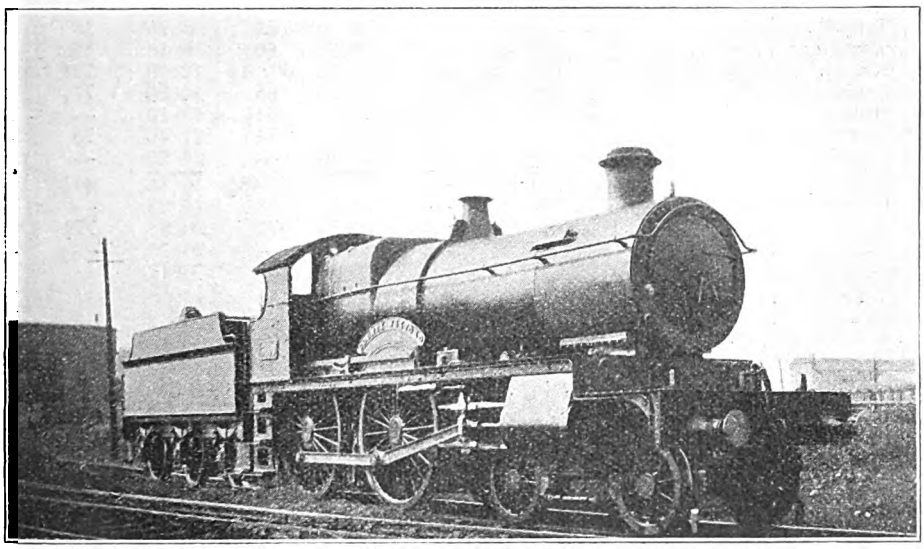

Photo.] [*F. H. Stingemore.*

G.W.R. 4-4-0 LOCOMOTIVE, No. 3809, "COUNTY WEXFORD."

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timing is certainly ambitious, to say the least.

I have also tabulated three more runs on the 2.55 p.m. from Birmingham to Paddington, which need no detailed description, as I have given all the maximum and minimum speeds recorded in parallel columns with the timings. The second of the three runs was by far the best, the only flaw being the way in which the driver, after attaining 66 m.p.h. at Knowle, after a brilliant start, suddenly eased down to 61½, although even then the time to Leamington was 1¼ min. inside schedule. Fine work was done from Leamington, and finer work still from Banbury, "even time" being passed in the first 20 miles and maintained unbroken right through to Northolt. The minimum rate of 55½ m.p.h. at Saunderton Summit was amazing, after 3¾ miles up at 1 in 200-176 and 2 concluding miles at 1 in 167, and we could have made Paddington in 67 min. from Banbury—and, incidentally,

G.W.R. 2.55 P.M. BIRMINGHAM—PADDINGTON.

Distance.	Four-cylinder 4-6-0 No. .. / Load (tons tare) .. .. / ,, (tons full)	Schedule.	4013(*a*) 217 230	*Speeds.	4014(*b*) 217 235	*Speeds.	4052(*c*) 250 270	*Speeds.	Summary of Minimum Times.
Miles.		min.	m. s.	m.p.h.	m. s.	m.p.h.	m. s.	m.p.h.	m. s.
0·0	Snow Hill	0	0 0	—	0 0	—	0 0	—	0 0
3·2	Tyseley	—	5 25	47	5 0	52	5 25	53	5 0
7·0	Solihull	—	9 45	—	8 50	60	9 10	65	8 45
10·4	Knowle	—	13 45	60	12 10	66/61½	12 10	72½	11 45
12·9	Lapworth	—	16 15	70½	14 35	65	14 20	77½	13 55
17·1	Hatton	—	20 15	—	18 40	61½	18 10	—	17 45
21·3	Warwick	—	23 50	77½	22 10	74	21 40	75	21 15
23·3	Leamington	26	26 5	—	24 40	—	24 20	—	23 30
6·1	Southam Road	—	9 55	—	9 5	51/48½	10 15	41½	9 5
11·1	Fenny Compton	—	15 45	—	14 10	58½	15 35	—	14 10
16·2	Cropredy	—	21 25	66	18 55	70½	20 35	77½	18 55
19·8	Banbury	24	25 20	—	23 0	—	24 10	—	22 30
5·1	Aynho Junction	6	6 55	61½	6 45	65	7 35	64	6 45
10·3	Ardley	—	12 45	49	12 0	55½	12 50	55½	12 0
14·1	Bicester	—	16 15	76½	15 10	85	16 0	80½	15 10
20·1	Brill	—	21 15	57	19 45	65	20 45	64	19 35
23·3	Ashendon Junction§ ..	23	24 45	54§	22 45	60§	24 0	60§	22 35
27·4	Haddenham	—	28 40	70½	26 30	72½	27 35	69	26 10
32·8	Princes Risborough ..	33	33 45	60	31 25	—	33 0	—	31 5
36·0	Saunderton	—	37 5	55	34 40	55½	36 40	47½	34 20
38·7	West Wycombe§	—	39 35	72½/58	37 10	70½/60	39 15	72½/71½ 75	36 50
41·0	High Wycombe¶	42	42 15	37¶	39 45	35¶	41 40	36¶	39 15
45·8	Beaconsfield	—	47 30	61½/60	45 0	61½/60	47 0	—	44 30
50·1	Gerrards Cross	—	51 15	76½	48 40	75	50 55	—	48 10
52·7	Denham	—	53 15	80½	50 45 sigs.	80½	53 0	83½	50 10
57·2	Northolt Junction ..	58	57 5	—	55 0	20	56 35	—	53 45
59·7	Greenford	60	59 5	74	sigs.	5	58 35	75	55 45
62·9	Park Royal	—	62 0	—	64 0	—	61 15	—	58 25
64·2	Old Oak Common West Jc.¶	65	63 45 sigs.	35¶	65 45 sigs.	30¶ 5	63 0 sigs.	30¶ 15	60 10
67·5	Paddington	70	69 40	—	73 45	—	69 50	—	‡65 10
110·6	†Net running times (min.)	120	120	—	114½	—	116¼	—	111¼

† No allowance for time lost in stopping and starting at Leamington and Banbury. * Maxima and minima, by chronograph. § Slight service slack. ¶ Severe service slack. ‡ Five minutes Old Oak—Paddington net time, based on working time. (*a*) "Knight of St. Patrick," (*b*) "Knight of the Bath," (*c*) "Princess Beatrice."

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have effected a punctual arrival, a thing I have never yet witnessed on this train, although on the third trip we were only 1 min. late—but for the terrible series of signal checks from Northolt onwards. *Knight of St. Patrick*, in the first column, did only moderately on the first two stages with 280 tons, in particular losing 1¼ min. from Leamington to Banbury, but there was no cause for complaint after that.

Princess Beatrice, on the third journey, after attaining 66 m.p.h. at Solihull on 72½ m.p.h., and actually accelerating to 75 between there and High Wycombe. It is of interest to note, on both the up and down Birmingham runs, that not a single check of any sort was encountered between Banbury and Leamington—a section on whose checking propensities I had had occasion previously to comment, but I am given to understand that a certain proportion of the delays then referred to were occasioned by trouble with landslips in the neighbourhood of

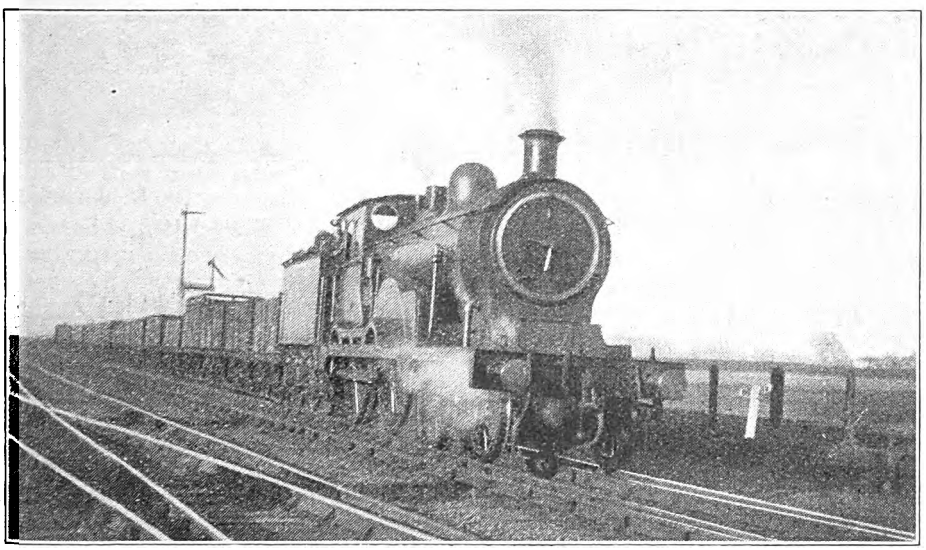

Photo.] [*G. H. Cannon.*

UP GOODS TRAIN PASSING TRUMPINGTON, NEAR CAMBRIDGE.

Great Eastern Section 4-4-0 Locomotive No. 1900, "Claud Hamilton."

grades mainly, if but slightly, adverse, worked up to 72½ on the level and 1 in 666 down between there and Knowle, and to 77½ at Lapworth troughs, so making a brilliant start to Leamington. Then a poor ascent was made of Southam Road bank, followed by a rapid acceleration to 77½ again beyond Cropredy, on very moderate grades. The least notable start from Banbury of the three was then made, as far as Saunderton, after which the driver electrified me by passing West Wycombe at Fenny Compton, and were therefore hardly preventable. The summary of fastest up times out of these three runs, in the last column, as well as of the fastest down journey times out of runs 1 to 4 inclusive, again affords an astonishing impression of the speed possibilities over this by no means easy route. It should be noted particularly that the times concerned are drawn from these runs *only*, which makes them all the more remarkable.

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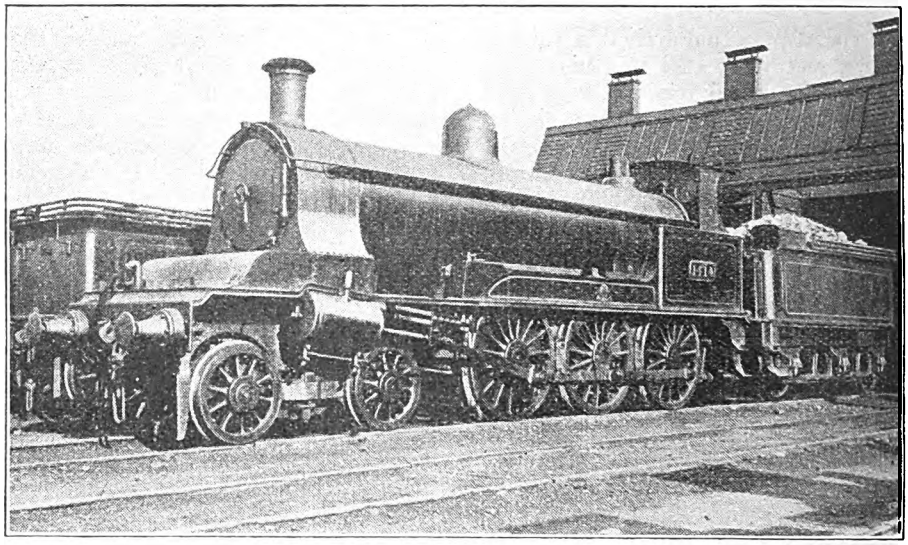

Photo.] [*W. H. Whitworth.*

FOUR-CYLINDER MIXED TRAFFIC 4-6-0 LOCOMOTIVE No. 1414.

Recollections of Crewe, 1897-1902.

[No. II.]

By J. G. B. SAMS.

DURING these four years, Nos. 1501 and 1502 were renumbered 1901 and 1902 and 38 sisters built in No. 8 Erecting Shop, also the enlarged "Jubilees" (No. 1941 upwards) were laid down and the 0-8-0 coal engine design changed from three- to four-cylinder compound. These latter engines were terribly clumsy-looking engines at the front end, looking as if they were about to fall forward, and this so worked on Mr. Webb's successor that he put a radial axle and carrying wheels under their smokebox, converting them into 2-8-0's! The real reason was, of course, that, unaltered, they had overmuch weight on the leading axle, and drivers have told me that they were uncomfortable engines to ride on in comparison with the three-cylinder 0-8-0's.

At the end of this period, I was moved into No. 8 Shop at the Steel Works, on new construction. Here I found three systems in force that have since become to a great extent standards in engineering practice. In No. 4 Erecting Shop a gang of men under a leading hand built one engine throughout from the frames, which were all put together by a specialist gang, and there were about ten new-work pits, each building an engine. But in No. 8 Shop, each pair of erectors, or an erector and apprentice, took a certain part of the engine and worked at that only on every engine as it was built, rapidly becoming specialists, the advantage being that by specialising the men did their parts better and quicker, and only needed the tools for their own particular jobs.

The next point was that the engines were built to spirit-level and jigs, and the cylinders, motion plates, &c., set to lines scribed along the frames, and not to piano-wire lines set up through the centres, the advantage here being a more standard engine owing to the greater accuracy all round. The last point was that the frames were laid down at one end of the shop by the identical leading hand (Teddy Battams) from No. 4 Shop, and as construction on them progressed, the engines were moved down the shop towards the

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exit, the final coupling-up and valve setting taking place on the end pits of all. This system is very largely used in motor-car and lorry construction to-day, the difference being that in the latter case the units under construction are moved forward on a slow-moving platform, while the Crewe method was to lift the engines further along the shop as required by overhead cranes.

During my year on new work, I think that I worked on every job about an engine and assisted to build four-cylinder compound coals, enlarged "Jubilees" and 18-in. tanks. About this time it was discovered that the enlarged "Jubilees" did better with 15-in. diameter cylinders (the same size as the "Jubilees" proper) than with their original 16-in. high-pressure pair, so as they came into the shops their high-pressure cylinders were linered up, the method used being a particularly evil and expensive one which I will explain.

After skimming the cylinders out to get them true, a gang of men at the run dragged lengths of white-hot rails from the boiler shop smithy adjacent and placed them in the cylinder to expand it a bit. When it was well hot, the liner, turned all over to size, was entered in the rear end of the cylinder and pulled into place with an enormous nut and bolt (about $2\frac{1}{2}$ in. diameter), with heavy bearers, one across the liner and the other across the far end of the cylinder. It took three gangs of men in turn on a heavy spanner to tighten up the nut, while other hefty individuals assisted the liner in by beating on the bolt head with a heavy hammer. Why the liner was not constructed with a light flange to fit over the cylinder end and turned an easy fit so that a pair of men could fit it in and bolt it up in about ten minutes, was one of life's mysteries to me; but seeing that I assisted at several of the above operations, it must have been the official way of doing it, and I expect that the whole class were done that way in turn.

In this shop I also helped to convert the large Crewe accident van crane from man to steam-power, but in this case I think that the drawing office forgot about such things as centres of gravity, because when taken outside the shop after conversion for a trial, instead of picking up the designed load from off the ground, the crane gracefully wound its jib end down towards it. So we took it into the shop again and hung huge cast-iron counterweights on behind its boiler to balance it; the boiler also was moved back as far as possible. That cured it of tipping up, so it was taken away, but whether it was ever any good at its work I never heard.

The only time that I actually encountered Mr. Webb personally was when engaged with a well-known Crewe erector, "Tip" Taylor by name, in fitting piston-valves and their glands and the return motion to one of the four-cylinder coal compounds then under construction. I was filing out one of the stud holes in one of the glands when a gruff, unknown voice asked me what I was doing, and I turned round to face Mr. Webb and the shop foreman, Mr. Joyce.

I explained the reason and then got into the pit and showed them that the gland would not fit the studs properly and therefore would have to be filed out; whereupon I heard him tell the foreman that the studs and glands were made and fitted to standard jigs in the fitting shop and that he would see Lindop (the fitting shop foreman) about it; so I expect that the unfortunate Mr. Lindop heard about it! As a matter of fact, it was seldom necessary to ease glands, &c., from the fittings shop, most things fitting up straight away.

The heaviest job about the new work was the final coupling-up and valve-setting, *i.e.*, getting the connecting and side rods into place after the engine is "wheeled," and then pinching her along the rails so as to get a sufficient traverse for valve-setting, which, to my surprise, always used to be done with the boiler empty.

The loading of the boiler with its proper quantity of water would bring the engine very considerably down on its springs and thus appreciably alter the valve setting, the valve motion being Joy's, which is always affected by vertical movement.

I expect that the first thing that would have to be done on receiving these engines at various running sheds for service would be to reset the valves properly under working conditions.

I got plenty of this heavy work, as I was fairly heavily built, but I must say that we were not expected to work very

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hard at it. There were always three hands on this section, an apprentice who was always a bird of passage, and two regular erectors named Walton and Capper, the latter being a crack Bisley shot and not too frightfully fond of work. He was easily the most amusing man that I met in the whole works.

I left Crewe just as the first of the 1400 class of 5-ft. 2½-in. 4–6–0 four-cylinder compound "mixed-traffics" was being laid down. This class cannot have been vastly successful, as they seemed to have a very short life indeed. They were designed to replace the "Special D.X.'s" on fast goods, passenger and excursion work and the wheel centres from broken-up D.X.'s were to be utilised.

Talking of wheel centres, that is the actual wheel but not the axle or tyre. Crewe was very economical with these. Thus, old "D.X." wheels were used again under any class with similar wheels (18-in. goods and tanks and 1400 class), and I have no doubt will be used under the next class with similar sized wheels, such as the present mixed-traffic engines, &c.

The wheel centres of Mr. Ramsbottom's 6-ft. and 6-ft. 6-in. 2–4–0 classes were used by Mr. Webb for his 6-ft. and 6-ft. 6-in. classes, as we have seen, and some of them may now be under other classes. I was told that the low-pressure driving wheels under the 7-ft. 2–2–2–0 and 2–2–2–2 classes were originally under 7 ft. "Bloomers" of Wolverton design and build.

All these wheels were of the old-fashioned hand-forged iron type and were practically everlasting. The building of them was a mighty smithing operation, which was done in this wise. First each spoke with its segment of rim and boss was forged up separately. These spokes were then placed in position and welded up at the boss end one at a time. Rings, one each at back and front of the boss, were then welded on, the arrangement following the idea of the tie round a bundle of faggots. Small pieces were then welded in between the rim ends of the spokes so as to make a continuous circle, and the completed wheel was then ready for the machine shop.

By the time I went to Crewe these hand-made wheels were very much out-of-date, cast-iron (forbidden for passenger work in those days) and cast-steel having taken the place of wrought iron, but I do not think that these cast wheels will last as long as their forged counterparts.

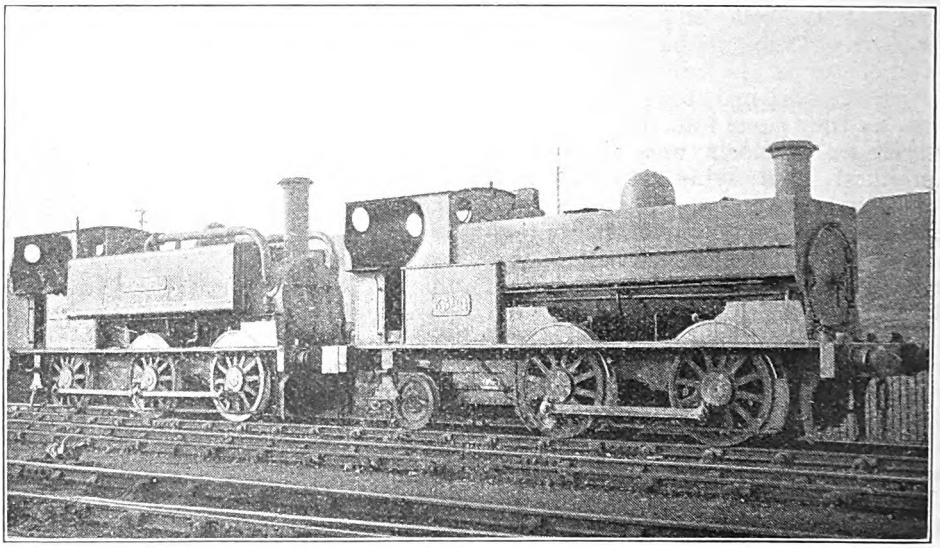

Photo.] [*P. F. Cooke.*

0-4-2 (BISSEL TRUCK) No. 3524 and 0-6-0 "LIVERPOOL" TANK ENGINES.

As used for working trains from the "Riverside" Station, Liverpool.

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Crewe cast-iron wheel centres were always of H section and all Mr. Webb's 0–6–0 coal engines, which were about the neatest and cheapest engines ever built of that type, had these wheels; but I expect that nowadays all wheels are steel castings on account of increased weights to be carried.

During my spell at Crewe the Bessemer process for steel manufacture was replaced by the Siemens-Martin Open Hearth system, and the heavy horizontal hammers, that always reminded me of rams fighting, replaced by hydraulic forging presses, of which I think the smaller (used chiefly on tyre forging and small axles) was of 1,500 tons maximum pressure, while the larger one, which was built in the mill-wrights' shop at Crewe, was of 2,000 tons maximum pressure and used chiefly in forging crank axles and pressing out ingots for plate rolling. The New Works were also largely increased in this period, No. 8 Erecting Shop and the Boiler Shop being extended and a fine new Erecting Shop (No. 9) built. The present head of Crewe was engaged in finishing off a very fine model of 1304, *Jeanie Deans*, scale about ½-in. to the foot which was the envy of all of us.

Mr. Webb should be remembered for many ideas in connection with locomotives. The system of having spare boilers for a numerous class, so that when in the shops the engine in question would not have to wait for its own particular boiler to be repaired, but could always be supplied with a boiler from stock, came from Crewe; and also the separate tender and engine idea, which is that any tender belongs to any engine, provided the tender is of the right class. This system economises tenders, it being possible to run, say, a class of 50 engines with 48 tenders owing to the shorter time taken repairing tenders over engines giving a higher percentage of availability.

In connection with locomotive boilers Mr. Webb made many endeavours to escape from the conventional, but only two of his ideas seem to have won through. One was the system of flanging the back plate of the outer firebox backwards so as to bring the rivets fastening it to the wrapper-plate outside the boiler instead of inside. This method allowed the rivets to be put in or taken out after the inner firebox was in place, impossible under the old style. This also allowed the inner firebox to be put in from the end instead of from underneath, which admitted of largely increased top width to the inner box, which is a great advantage.

His other remaining idea was the system of doubling back the two fireboxes at the fire hole and rivetting them together without the usual ring in between.

I saw a boiler built and fitted to an 0-6-0 coal engine with a Belpaire-type top, but with brick walls instead of water-space and copper-plate round the four sides of the box; unfortunately the road soon rattled the bricks down, and the last I saw of this boiler was on stationary duty in the Steel Works Yard.

Another coal engine boiler was built with a circular flue instead of an ordinary firebox, somewhat like a Cornish boiler flue, but there must have been something wrong here as it was not perpetuated, although I believe the Lancashire and Yorkshire Railway built some similar boilers for certain of their heavy 0-8-0 goods engines.

A number of "Special D.X.'s" were fitted with boilers having fireboxes shaped like the figure 8, with a water arch across the front of the narrow part in lieu of the usual brick variety. These boilers had water bottoms instead of ordinary ash-pans, and were prone to give trouble with leaky stays at the narrow part. Crewe used to be very fond of water-bottom fireboxes, a large number of the passenger compounds being so fitted. Their defect was lack of circulation as the water bottom was under the heat, and it was often possible in winter to see icicles on the fire-box bottom of an engine in steam!

Mr. Webb was also responsible for rolling the first sixty-feet length rails which were laid down between Crewe and Betley Road about 1896. For many years after other railways were quite content to go on with 30 and 45 ft. lengths, hence the superiority of the London and North Western Railway track, which they rightly claim to be the finest in the world. This is largely due, I think, to the extreme length of the rails which reduces the number of bumps felt when the wheels pass over the rail joints.

Towards the latter end of my time the 5-ft. 9-in. "Metropolitan" tanks started

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to be broken up. These engines were built in the 'seventies by Messrs. Beyer, Peacock & Co., and when new were of the well-known London Underground pattern of 4-4-0 tank engines with outside cylinders. Mr. Webb rebuilt these as 4-4-2 engines, fitted cabs, and removed the condensing gear. They finished their time up at Longsight (No. 16) shed, where they were very largely used on the Manchester South Junction & Altrincham line; a suburban service, it is true, but somewhat different from the Mansion House–Broad Street services for which they were originally purchased.

RAIL-BUS AT PORTRUSH, NORTHERN COUNTIES SECTION, L.M.S.R.

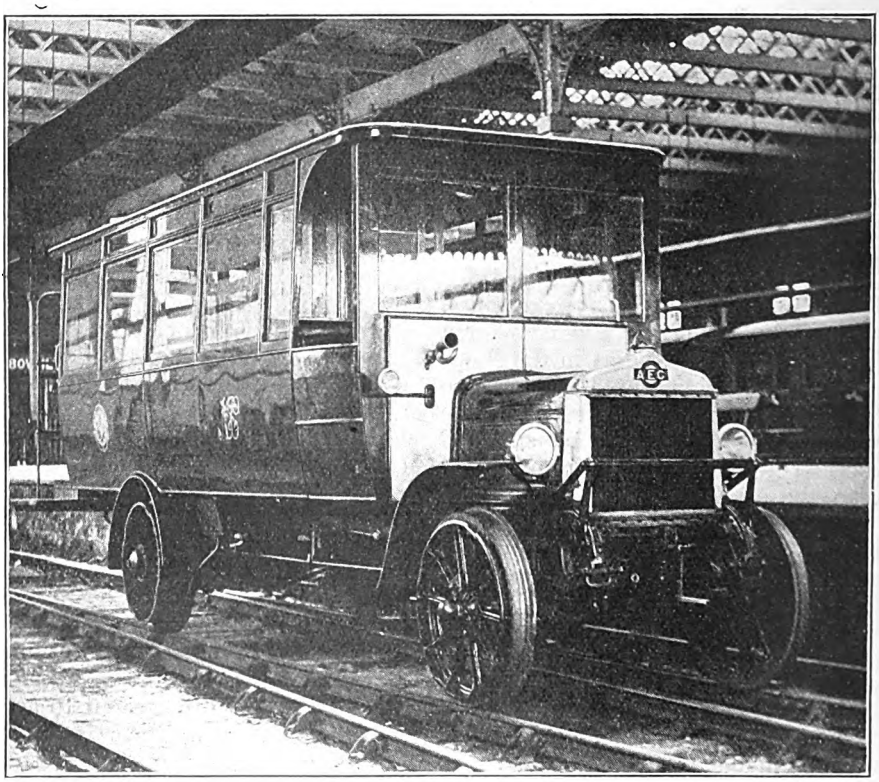

Photo.] [*W. A. Law.*

This vehicle is an adapted Motor Omnibus. It has been running regularly between Coloraine and Portrush in order to amplify the steam services.

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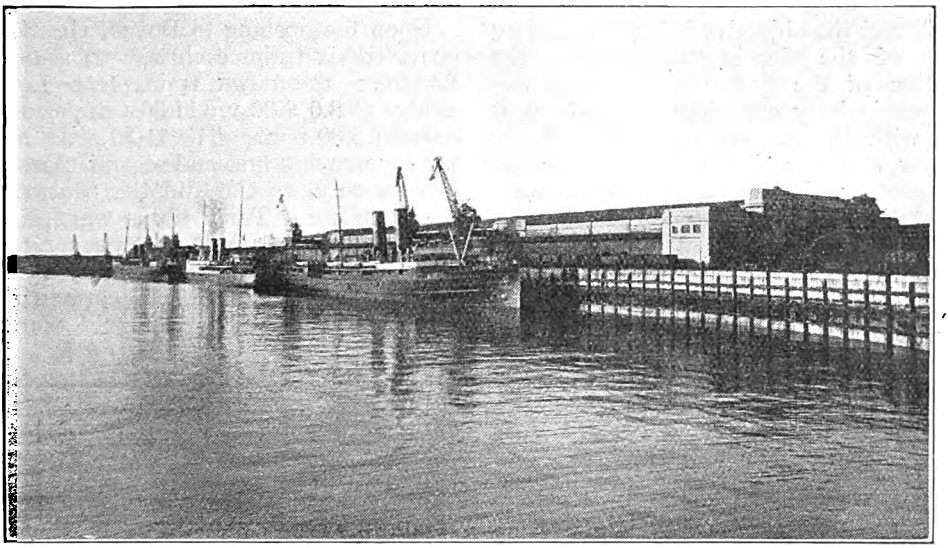

GENERAL VIEW OF MARINE STATION, DOVER, AND STEAMER BERTHS.

Dover Passenger Train Services, 1844-1923.

By G. A. SEKON.

DOVER has from the earliest days of the "discovery" of Britain, constituted in some respects the most important town in this island. This premier importance results from it being the "gateway of England." As the town in Great Britain nearest to the outside world, the land transport arrangements to the interior of the island have at all times been of the utmost consequence. These have always been framed primarily with reference to communications by water to and from the Continent. Although Dover* is a town of fair size and is yearly increasing in extent, and its local commercial importance advances year by year, the chief train services are framed for the convenience of the big Continental traffic.

Some years before the railroad reached Dover, steamboats superseded the sailing packets that had sailed regularly to and from the port for many centuries. The Dover road through Chatham and Canterbury was the busiest and best known of the many highways radiating from London. The first railway, however, between the Metropolis and Dover, did not follow the course of this important highway for two very good reasons. First—and of itself quite sufficient—Parliament decided in 1839 that one railroad outlet from London to the South was all that would be permitted. The second good and sufficient reason against the railway following the course of the road was the extremely hilly nature of the country traversed by the highway.

Parliament having decided that the railroad to Dover should be the same as that to Brighton, until a point as far as south of London as is Dover was reached, the original line diverged from the London–Brighton trunk railway at Redhill. Although this decision of our legislators made the distance by railway between London and Dover 88 miles against 68 miles as the crow flies, the *détour* produced a straight and level line for the greater part of the distance and, moreover, one void of expensive engineering works, except at the east end, where are the Foord Viaduct at Folkestone and the tunnels and cliff terrace between Folkestone and Dover. The approach to Dover by railway being along the sea

* Up to 40 years ago frequently spelled Dovor.

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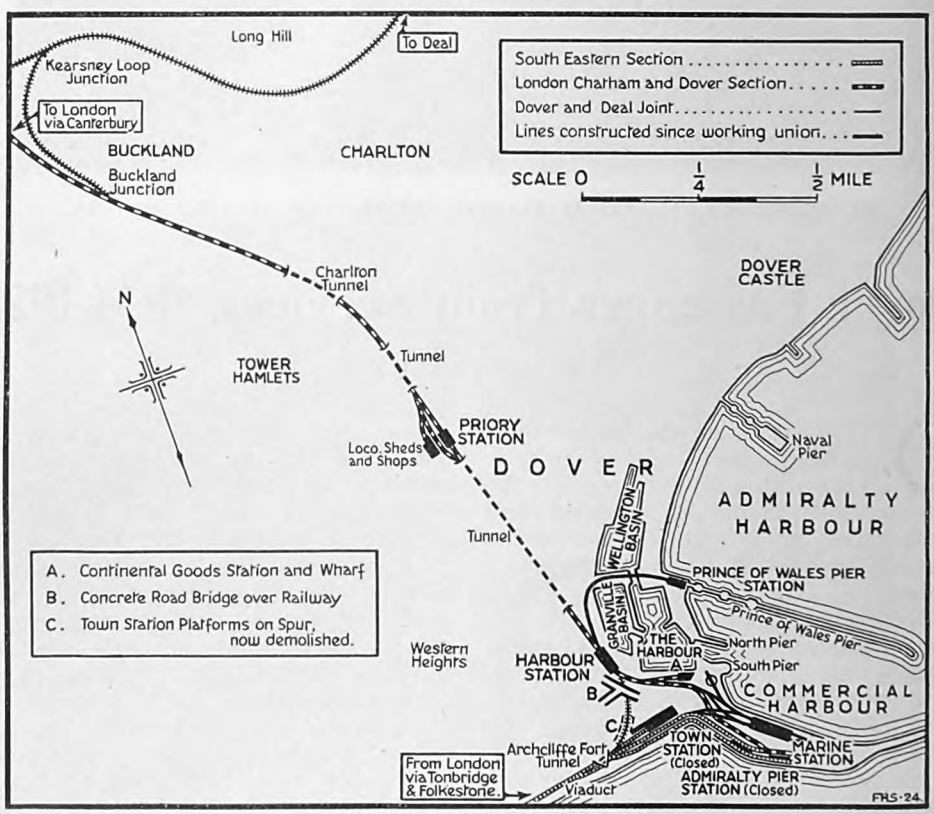
beach and the objective being the landing place of the Continental packets, the location of the first Dover station was not particularly convenient, situate as it was with the sea on one side and the narrow streets adjacent to the harbour on the other. Designated "Dover Town" the station was probably considered commodious and convenient when it was opened, in place of the temporary one brought into use in February, 1844, and remained the principal Dover station for

Upon the opening to Dover, the S.E.R. provided six trains each way to and from London; the down trains left London Bridge at 8.0, 9.30 and 11.30 a.m., and 1.30, 4.0 and 5.30 p.m. The 11.30 was a fast train conveying first and second-class passengers only, as also did the 8 a.m. and 4 p.m. trains. Three trains were, therefore, available for third-class passengers.

At that time there was no railway from Calais, and the S.E.R. concentrated upon the Folkestone–Boulogne route to



PLAN OF RAILWAYS IN VICINITY OF DOVER.

general traffic with but minor alterations till 1914, when war requirements necessitated its closing, although it was not suitable for dealing with modern traffic. It comprised one long platform with a bay at the west end and two carriage lines. When rail communication was made with the Admiralty Pier, a platform was provided beyond, but parallel with, the carriage lines for the accommodation of trains running through to and from the pier.

France and South Europe, although steamers ran between Dover and Calais. The Belgian Government also ran a steamer daily between Dover and Ostend in connection with which the S.E.R. gave an additional fast train to Dover. The opening of the Bricklayer's Arms station in May, 1844, also resulted in additional trains being run between London and Dover.

The opening of the L.C. & D.R. to Dover

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on July 22, 1861, increased considerably the importance of the town from the railway viewpoint. The new station, which was the temporary terminus of the line, is situate in the centre of the town fronting the Folkestone Road, and for the few months until the extension to the Harbour station was opened was called Dover Town. Apparently at that time the S.E.R. merely called its (Town) station "Dover." The impression of those unacquainted with Dover is that this station (now named "Priory" after the adjacent ruins of St. Martin's Priory) is a Dover suburban station. This erroneous view is strengthened by the circumstance that from the opening of the Harbour station the L.C. & D.R. treated the Harbour station as its principal Dover station, because in those days Dover was considered chiefly in connection with Continental traffic.

The Priory station is situate between two tunnels near the bottom of a gradient which commences at Shepherd's Well, six miles away. The first five miles are at 1 in 132 and at 1 in 105 for the remainder, the 1 in 105 gradient is continued to the Harbour station. Priory station still consists of two short narrow platforms connected by a narrow subway; part of the station is spanned by a wooden roof. All Dover engines are now shedded at Priory, and for the better working of light engines to Marine station a line runs at the back of the up platform with a connection at the south end with the down line only.

The first L.C. & D.R. service consisted of six trains in each direction between London and Dover, with boat trains in addition. There were also two up and two down locals between Dover and Canterbury. The Dover–Calais steamer service was at this time a tidal one, so that boat expresses run at various times, being altered two or three times weekly. The S.E.R. route to Dover was at this time *via* Redhill, so the much shorter route of the L.C. & D.R. necessitated a reduction in fares, but express fares were at the same time introduced. The L.C. & D.R. express trains took 2 h. 20 min. between London and Dover, the stopping trains being allowed one hour longer.

On November 1, 1861, the L.C. & D.R. was extended about three-quarters of a mile to the Harbour station; the extension passes beneath the Citadel Heights fortifications of Dover by means of the Priory tunnel 685 yards in length. Prior to its opening to Dover the L.C. & D. Railway had acquired the Dover–Calais mail packets, so that it was in a strong position to command the Continental traffic, whilst the fact that its route to London was 11 miles shorter than that of the S.E.R. and also that it removed its locomotive works to the Priory, were calculated to obtain for the new line the patronage of the inhabitants of Dover. The Harbour station is not commodious, having an up and a down platform; there is, however, a middle road without a platform for the use of Continental trains not stopping. The up platform is continued as a terminal bay for about 100 ft. beyond the point where the line from the Marine station joins it. At first the L.C. & D.R. Continental trains terminated at and started from the Harbour station. The L.C. & D. Railway was for many months at a disadvantage at Dover, as its railway terminated at the Harbour station, but in 1862 powers were obtained to extend the line along the quay to the Admiralty Pier, a distance of about 500 yards. After the lines had been laid along the quay to the Admiralty Pier, further delay occurred as "my Lords of the Admiralty" required some alteration to be effected before they would sanction the use of the L.C. & D.R. extension. The line from the Harbour station to the Marine station is now single, the second line being reserved for goods traffic. In October, 1862, the Dover–Calais service was made a fixed one, but as the railway from Calais to Boulogne was not opened till 1867 the Folkestone–Boulogne route still retained its popularity.

The station on the Admiralty Pier consisted of two fairly long, extremely narrow and rather low platforms, placed tandem-wise, that of the S.E.R. being nearer the land end of the pier. As the S.E.R. trains conveyed the mails, although the route from London was longer, there was never the possibility of its passengers being left behind, the steamers being compelled to await the arrival of the mail trains. The best L.C. and D.R. Continental train in October, 1864, was quickened to 1 hour 50 min. Victoria to

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Dover Harbour, and 5 min. longer to the pier.

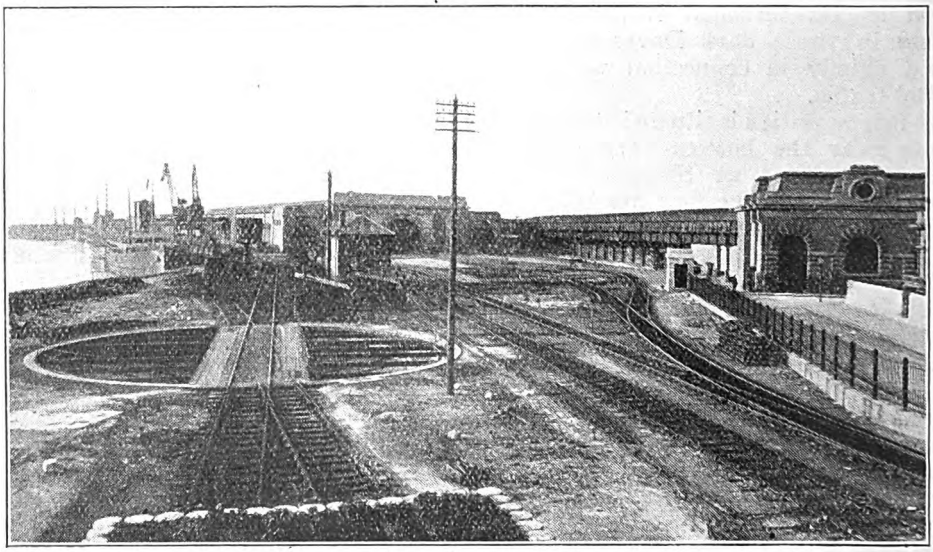
The opening of the direct Tonbridge line of the S.E.R. for passenger traffic in June, 1868, saving 13 miles in the distance between London and Dover, placed the S.E.R. route on an equality with that of the L.C. & D.R. The distances are: L.C. & D.R. Victoria to Dover Harbour, 78 miles, and S.E.R. Charing Cross to Dover Town, 76½ miles.

The S.E.R. for many years prior to the working arrangement with the L.C. & D.R. had an up train, that had no complement on the rival system. Known as the "Ostend Mail," the train left Dover at 1.55 a.m. and, calling only at Staplehurst, was due at Cannon Street at 3.45 a.m., in time for the mails from Belgian and North Eastern Europe to be dispatched by the early trains from London to the provinces. The train was also the mail train for much of Kent, and if the Ostend boat was so late as to delay the train more than 15 min. the mail did not wait, as the Kentish letters were required to reach London in time to be sent forward by the early trains. The mails from Margate, Ramsgate, Canterbury, &c., were conveyed by road to Dover to catch this mail train and from other far-off places to Staplehurst for the same purpose.

As the Post Office required the afternoon Continental mail to be delivered in London in time for letters for the provinces to be dispatched by the night mails, the S.E.R. had a rule that if the boat were late, passengers from the Town Station were to proceed to the Pier Station and there join the train, which would on these occasions pass through the Town Station without calling.

The next event of importance in railway matters at Dover was the opening of the joint Dover and Deal Railway on June 15, 1881.

This necessitated the construction of a railway at ground level for a distance of 19 chains through the thickly populated district between the west end of the Town station and the south end of the Harbour station. This line, we believe, held the record for the number of roads crossed on the level within a ¼-mile—there being six in the 19 chains. A few years ago the Railway and Harbour Board acquired the numerous properties served by these crossings. To accommodate the vehicular traffic to and from the Admiralty Pier district and the newer parts of Dover, a reinforced concrete viaduct has been built over this line for road traffic and the level crossings abolished. A feature of the viaduct is that a branch viaduct leaves it at right angles to serve the Old Folkestone Road, &c. The small



GENERAL VIEW OF MARINE STATION, DOVER, AND APPROACHES.

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houses on the site have been demolished and railway sidings, &c., are to be laid down. Warehouses, hotels, &c., between the Harbour station and the Admiralty Pier are empty, in fact this part of Dover is now almost derelict.

When the Dover and Deal line was opened, two short platforms, without superstructures, were built on the spur, adjacent to the Folkestone end of the Town station. Speed is restricted to 8 miles an hour over the spur. A service of 8 trains each way was provided on weekdays by the two companies, those of the S.E.R. called at the branch platforms of the Town station and all trains at the Harbour and Priory stations diverging at Buckland Junction, 73 chains east of the Priory station and running along the north side of Dover. The Sunday service and all goods trains were worked on alternate days by the two railways. The gradient of the joint line for 2¾ miles from the junction is 1 in 70 up. By adopting a gradient of about 1 in 50 and tunnelling under the town for a distance of about ¾ mile, about 1½ miles would have been saved in the length of the joint line, but would have necessitated the L.C. & D.R. extending at its own cost its connecting spur between Deal Junction and Kearsney along the course now occupied by the joint line for about a mile, till the point where the shorter route above suggested would have diverged.

For several years the London–Dover services were not increased or accelerated materially, but the Continental services had a standard timing of 1 hour 40 min. Cannon Street to Admiralty Pier and 1 hour 45 min. Victoria to Admiralty Pier.

In 1889 the "Paris Limited," afterwards named the "Club train," was put on; at first it left London (by both routes) at 4.15 p.m. and reached Dover at 6 p.m. The rolling stock was supplied by the International Sleeping Car Company and only first-class passengers were carried, who were charged a supplementary fare beyond the usual express fare. The return train left Dover about 9.30 p.m. The service was not well patronised and was withdrawn after a few months' trial. The fares between London and Dover included express, as well as ordinary, as previously stated. The express fare to Dover, plus the steamer fare, Dover to Calais, and the express fare Calais to Paris, were together considerably less than the through fare London to Paris. Many people sought to save their pockets by booking to Dover, and then re-booking for the steamer. The L.C. & D. effectively stopped this. We believe the plan adopted was to carry passengers at express fares to and from the Priory station only, and not to stop the boat trains at that station.

It was then discovered that Paris could be reached more cheaply by booking from London to Calais and re-booking there. To meet this attempt at cheaper travelling the fare to Calais was increased, but a passenger was successful in an action decided in May, 1893, that the first-class express fare to Calais was 30s. 2d. and not 34s. 4d., charged by the L.C. & D.R. The railway sought to justify the higher fare by alleging it was empowered to charge 1s. per mile for 2 miles at Victoria, the same sum per mile for 2 miles on the Mid-Kent Railway, and something beyond the statutory 3d. per mile for the railway on the Admiralty Pier, together with a charge for transferring baggage from the train to the steamer. The judge refused to allow any of these extra charges.

The working union of 1899 produced little difference in the Dover services at first. The S.E.R. trains ceased to make use of the Town platforms on the connecting spur, which were afterwards removed; passengers for this district of Dover using the adjacent Harbour station. The 3.40 a.m. up Continental mail was diverted to the Chatham route between Dover and Rochester Bridge, continuing thence to Cannon Street over the North Kent line. During the time the Government Harbour Works were under construction, it was impossible under certain weather conditions for the steamers to use Dover. On these occasions the Calais boats ran to and from Folkestone and the Ostend service was based on Port Victoria. The L.C. & D. section trains ran to Folkestone via Maidstone East and Ashford, a stop being made at the latter station to pick up or set down the S.E. pilotman.

Dover Town continued to be used for S.E. section main-line traffic, and for trains over the Elham Valley Line, which were not "roundabouts." During the

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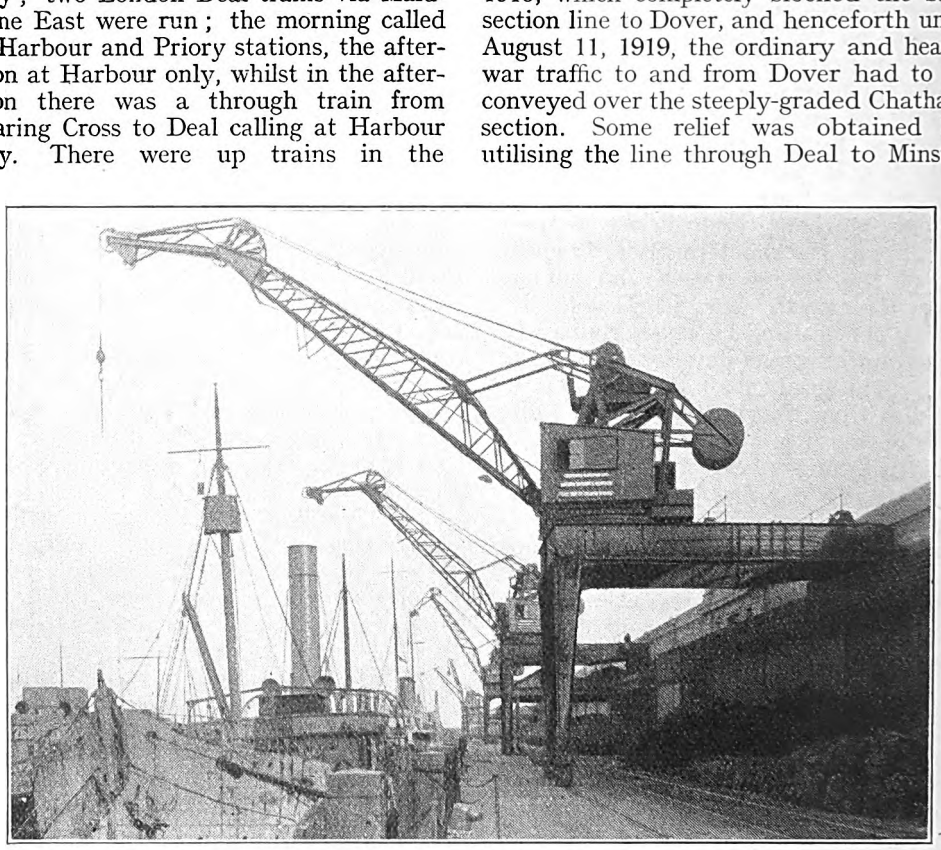
summer of 1907 a rail motor car service was run on weekdays (except Thursdays) between Dover Town and Sandgate, reversing at Sandling Junction. In this year also the L. & N.W. and G.W. through trains were running to Deal, via the Spur, calling at the Harbour station only; two London–Deal trains via Maidstone East were run; the morning called at Harbour and Priory stations, the afternoon at Harbour only, whilst in the afternoon there was a through train from Charing Cross to Deal calling at Harbour only. There were up trains in the morning from Deal, but they called only at the Harbour Station.

The construction of the Prince of Wales' Pier within the National Harbour at Dover resulted in Atlantic liners calling there. To provide rail connection with the pier a line was laid down from the Harbour station. The position is so confined that the connecting line could only effect a junction with the middle line in the station. To do this it passes across the down line and down platform on a sharp curve. A portion of the down platform is supported on a girder on rollers at one end and pivoted at the other. This part of the platform is moved on the pivot to enable trains to pass to and from the Prince of Wales' Pier.

When the railway was congested with war traffic a landslide took place in the Warren, near Folkestone, on December 19, 1915, which completely blocked the S.E. section line to Dover, and henceforth until August 11, 1919, the ordinary and heavy war traffic to and from Dover had to be conveyed over the steeply-graded Chatham section. Some relief was obtained by utilising the line through Deal to Minster and by putting in junctions between the two sections at Canterbury and Margate.



CRANES ALONGSIDE DOVER MARINE STATION.

From August 11, 1919, when the line between Folkestone and Dover was reopened, 10 trains that had terminated at Folkestone were extended as follows: 3 to Dover Harbour, 2 to Dover Priory, 4 to Deal calling at the Priory, and 1 to Deal calling at the Harbour.

The up service via Folkestone was: From Deal calling at Priory 4 and calling at Priory and Harbour 4. The local service, Shorncliffe to Minster, &c., was

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also reinstated. It will be seen that the Town station was not again brought into use.

The fine Marine station at Dover was approaching completion when the war broke out and was utilised for military traffic during the war, but its use for public Continental traffic was delayed until January 8, 1920. One ordinary Chatham section train ran to and from the Marine station in October, 1920, and the full service from July, 1921; in February, 1922, the Marine station began to be used for S.E. section trains. A full account of this modern terminus with several illustrations appears in the RAILWAY MAGAZINE for June, 1919. With the Marine station on an adjacent site, the Town station, after being in use for nearly 80 years, was closed, whilst the few trains now calling at the Harbour station (also close to the Marine terminus) are chiefly those of the coast service between Folkestone, Dover, Deal, Ramsgate and Margate.

The broad scheme of train services at Dover now is that London trains over the Chatham section run to and from the Marine station (instead of the Harbour station) at which they do not call. They mostly stop at the Priory station. The S.E. section London trains that previously started and terminated at the Town station are mostly continued over the spur to the Harbour station (not calling) to the Priory, at which a few terminate or start. Mostly, however, they continue or originate further afield, the route being over the line to Deal, which town, with Sandwich, Minster and Margate, form the ultimate destinations or starting points.

The following is an analysis of the London–Dover train service in operation during the summer of 1923:—

S.E. SECTION, DOWN—

Weekdays.—To Marine 2, to Harbour and Priory 2, to Priory 10, to Marine and Priory 1.

Sundays.—To Marine 1, to Marine and Priory 1, to Priory 3.

S.E. SECTION, UP—

Weekdays.—From Marine 3, from Marine and Priory 1, from Priory and Marine 1, from Priory and Harbour 1, from Priory 8.

Sundays.—From Priory 5, from Priory and Marine 1.

CHATHAM SECTION, DOWN—

Weekdays.—To Priory 5, to Priory and Harbour 1, to Priory Harbour and Marine 1, to Priory and Marine 5.

Sundays.—To Priory 2, to Marine and Priory 1, to Priory and Marine 1.

CHATHAM SECTION, UP—

Weekdays.—From Marine and Priory 8.

Sundays.—From Marine and Priory 1, from Priory 4.

Some explanation of the tables is necessary. The down train to the Marine and Priory stations over the S.E. section is the through train from the G.W.R. system via Redhill. This train reverses at the Marine station and continues to Deal, calling at the Priory. A probable reason for running into and out of the Dover terminus may be that the "foreign" rolling stock is not suitable for working over the sharp curve of the Spur between the S.E. section and the Harbour station.

The two trains which call at the Harbour and Priory stations are the 3.40 and 5.20 a.m. from Cannon Street. They convey chiefly perishables, newspapers, parcels, &c., which traffic is largely dealt with at the Harbour station. One of the trains included in the Priory total is the 11 a.m. from Charing Cross via Chislehurst loop, Maidstone East and Ashford. This terminates at Margate Sands. The one up from Marine and Priory runs over the Chatham section to Rochester Bridge and thence over the North Kent line to Charing Cross. It leaves at 6.33 a.m. The through train to the G.W.R. is the solitary example calling at Priory and Marine. The Harbour station has now only 13 trains calling at it, there is a probability that it will be closed in the near future. As the Marine station, built principally for Continental traffic, is inconveniently situate for Dover itself, the Priory station becomes the principal station for the town. This will probably be rebuilt on a much enlarged scale to enable it adequately to accommodate the large traffic that is now dealt with there.

With two distinct routes arriving in opposite directions it is impracticable to refer to trains at the Priory and Harbour stations as "up" and "down." We,

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therefore, distinguish below all passenger trains (local and London) using the up and down platforms. The totals are :—

Priory :

Up platform, 33 ; Down platform, 35.

Harbour :

Up platform, 7 ; Down platform, 6.

As the trains arriving at the Marine station by both routes are " down " and those departing are " up," and since some trains arrive by one route and depart by the other, we give the total of trains (31) using the Marine station, counting those that both arrive and depart as one only. None of the boat trains has been referred to in this table, nor trains that run on certain days only, save that trains that run " Saturdays excepted " have been included.

It was mentioned earlier that there were both express and ordinary fares in operation to and from Dover. The former are not now shown in the lists of fares, but travellers other than those to and from the Continent can make use of the boat trains by paying express fares.* Those that do so are usually accompanying Continental passengers to or from Dover, as the boat trains are not shown in the ordinary time-tables.

* Charing Cross and Dover, first-class fares: Ordinary, 16/3 ; Express, 29/3.

Railway Returns for 1923.

A PRELIMINARY statement containing summarised particulars of the accounts and statistical returns of the railways in Great Britain for the year 1923, compared with the years 1922 and 1913, has been issued as a White Paper. In addition to totals for Great Britain, the statement shows separately the aggregate figures for the companies constituting each of the four great amalgamated undertakings. The particulars for Great Britain relate to all railways, except that certain statistical information is not available for about 85 miles of narrow-gauge line. The 1923 figures are provisional, as those for some of the smaller companies are estimated, and the figures do not include particulars in respect of the Manchester Ship Canal.

Total passenger train receipts were £94,100,000 in 1923, against £101,786,000 in 1922 and £54,526,000 in 1913. Compared with 1922, there were decreases under every head, except that third-class season tickets showed a slight increase. At the same time the number of " originating " passengers (excluding the District Railway and the London Tubes) rose from 945,465,000 in 1922 to 1,000,741,000 in 1923. The total freight tonnage originating on the railways of Great Britain was 342,995,000 in 1923, as compared with 301,625,000 in 1922 and 364,424,000 in 1913. Coal, &c., tonnage in 1923 was only some 3,362,000 short of that of 1913, but general merchandise and " other minerals " are, respectively, 8,982,000 tons and 9,084,000 tons short of the 1913 figures.

Mileage of lines open for traffic, *i.e.*, total single track, including sidings, was 51,782 in 1923, compared with 51,586 in 1922 and 50,604 in 1913. For general merchandise the average haul was 82·75 miles, for coal, &c., 42·91 miles, and for other minerals, 51·72 miles in 1923, the corresponding figures for 1922 being 85·10, 44·41 and 49·46. The average receipt per ton-mile was 2·50d., for coal, &c., 1·02d., for other minerals 1·13d., and for all descriptions of traffic 1·47d. in 1923. Corresponding figures for 1922 were 3·048d., 1·088d., 1·390d., and 1·714d.

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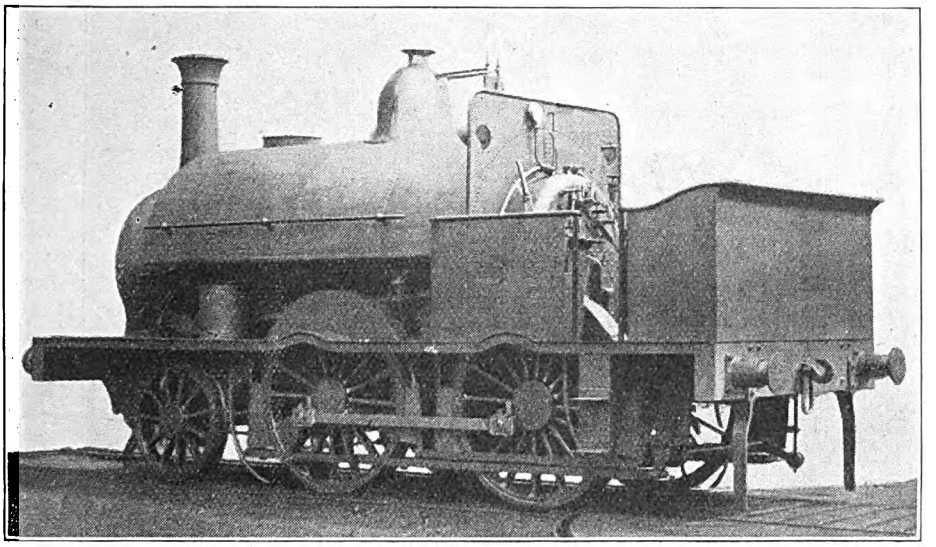
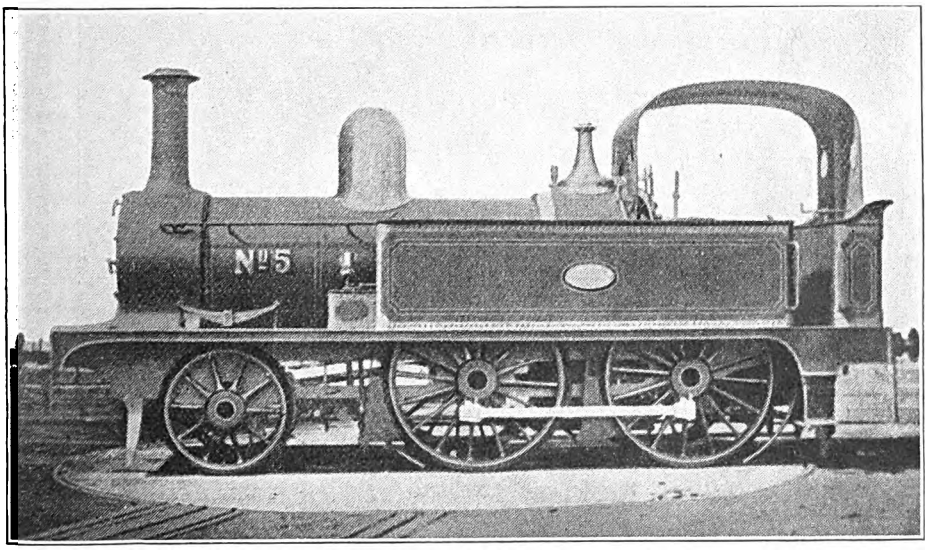
OLD LOCOMOTIVES, BELFAST AND COUNTY DOWN RAILWAY.





We are indebted to a Belfast reader for the photographs reproduced showing old tank engines taken over by the Belfast and County Down Railway from the Belfast, Holywood and Bangor Railway. That shown above was built in 1865 by the Vulcan Foundry Company. It had cylinders 15 in. by 20 in. and coupled wheels, 5 ft. diameter. The second was built by the Yorkshire Engine Company in 1870, and had 12-in. by 22-in. cylinders and 5-ft. coupled wheels. These engines became, respectively, Nos. 15 and 19 in the Belfast and County Down list.

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Four-Cylinder 4-6-4 Express Tank Locomotive, L.M.S.R.

TO meet demands in the Manchester and other districts, where fast residential expresses making journeys of 50 or 60 miles are run, for a powerful tank engine, capable of hauling heavy trains over severe gradients at high speed with quick accelerative powers, Mr. G. Hughes, C.B.E., Chief Mechanical and Electrical Engineer of the L.M.S.R., has designed a 4-6-4 (or "Baltic") tank locomotive having notable characteristics.

Taking as his prototype his four-cylinder 4-6-0 express locomotive with 6 ft. 3 in. coupled wheels, which have proved so successful in hauling the heavy trains on the late Lancashire and Yorkshire Railway, Mr. Hughes decided to adapt this design in tank engine form. Ten of these engines are to be constructed at Horwich, and No. 11,110 is already in service. A photograph of this engine is reproduced on the opposite page illustrating the locomotive in its final stages before leaving the erecting shop.

These engines will be largely employed on hauling the heavy residential express trains running between such resorts as Blackpool, Southport and Llandudno and Manchester, and several will be available in service during the coming season.

The chief modifications as compared with the corresponding 4-6-0 tender engines relate to the provision of coal and water accommodation on the engine frame; otherwise as little departure as possible has been made from the tender engine design. The frames have been lengthened at the rear to take the bunker and trailing bogie, the wheelbase has been lengthened somewhat to comply with permanent-way restrictions, and the grate area of the firebox has been increased from 27 to 29·6 sq. ft.

The superheater employed is the "Horwich" design, commonly known as the "top and bottom" header superheater designed by Mr. Hughes. In this the elements are placed in a vertical position down each side of the boiler, instead of horizontally as in most other types. Separate cast-iron headers are used for the saturated and superheated steam, those for the latter being bolted directly on to the cylinder castings, thus doing away entirely with intermediate steam pipes, and having the advantage that the saturated steam has no opportunity of exerting any cooling effect on the superheated by having both in the same header. By this arrangement, also, it is claimed that a more even distribution of temperature in the tubes results, so that trouble with leaking flue tubes is greatly reduced. It may here be mentioned that there is another design of "Horwich" superheater, also designed by Mr. Hughes, known as the "twin plug" type, which is somewhat similar in arrangement, but has the advantage that each element may be removed without disturbing any of the others, but in everyday running the "top and bottom" type is found to be more satisfactory.

The four cylinders of the "Baltics" are in three separate castings, individually bolted to the frames, the two inside cylinders driving the leading coupled axle through connecting rods 6 ft. 8 in. long, whilst the intermediate coupled wheels are driven from the outside cylinders through connecting rods 11 ft. long. The steam passages have been kept as short and direct as possible. In adopting a long valve travel, the best modern practice has been followed, and the greatly improved distribution which results more than counterbalances any disadvantages which may be urged against it.

The piston valves are fitted with Mr. Hughes' patent pressure release valves, in which steel balls are held by steam chest pressure against seatings connected by passages to the outer periphery of the valve. Any excess of pressure in the cylinder due to trapped steam, air or water automatically forces the balls off their seatings, and escapes into the steam chest. The valves, which have a diameter of 9 in., are actuated by two sets of Walchaert

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gear. The table of dimensions reproduced at the end of this article shows that the large boiler is interchangeable with the 6 ft. 3 in. six-coupled express engines already mentioned.

The total water capacity of the tanks is 2,000 gallons, namely, 500 gallons in each of the side tanks and 1,000 gallons in the bunker tank. A coal capacity of 3½ tons is provided. The engine develops a tractive force, at 85 per cent. of the boiler pressure, of 28,879 lb. In working order No. 11,110 weighs 99 tons 17 cwt. :—

	Tons.	Cwt.	Qr.	Lb.
Weight per foot run on coupled wheels ..	4	2	0	12
Weight per foot run on engine wheelbase ..	2	9	2	2
Weight per foot run over buffers ..	2	0	0	5

Weight available for adhesion is 55 tons 15 cwt.

Leading dimensions are as follows :—

Cylinders (4), diameter ..	16½ in.
,, piston stroke	26 in.
Wheels, coupled diameter	6 ft. 3 in.
,, bogie diameter ..	3 ft. 0·⅜ in.
Wheelbase, bogie ..	7 ft. 0 in.
,, rigid	13 ft. 7 in.
,, total	40 ft. 4 in.
Boiler, length between tube plates	14 ft. 8 in.
,, diameter inside front end ..	5 ft. 7 in.
,, height of centre from rail ..	8 ft. 11 in.
Firebox, length outside ..	9 ft. 6 in.
Boiler heating surface (water side)—	
Tubes (large and small)	1,817 sq. ft.
Firebox	180 sq. ft.
Total	1,997 sq. ft.
Superheating surface (steam side)	430 sq. ft.
Grate area..	29·6 sq. ft.
Working pressure ..	180 lb. per sq. in.

LOCOMOTIVE AND TRAIN WORKING IN THE LATTER PART OF THE NINETEENTH CENTURY.

⊛ ⊛ ⊛

Under this heading Mr. E. L. Ahrons will deal with the Locomotives and Trains of the

NORTH LONDON RAILWAY

in the forthcoming RAILWAY MAGAZINE, June, 1924.

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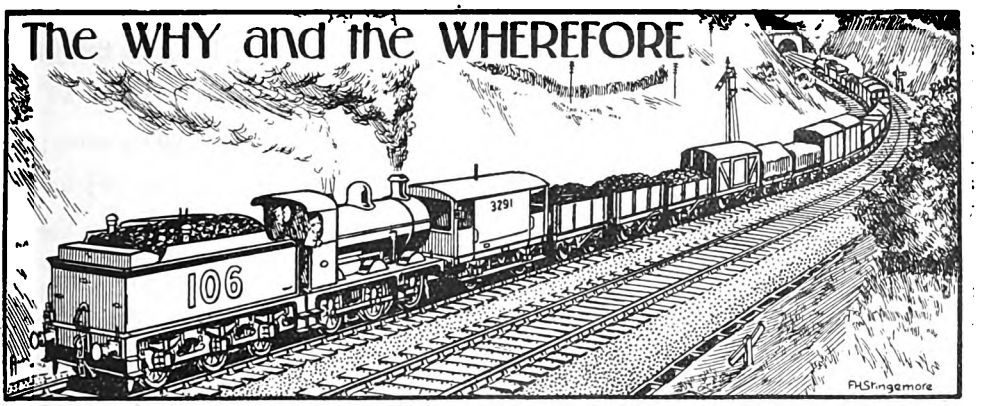

Railway Magazine readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o Railway Magazine, 33, Tothill Street, Westminster, London, S.W.1. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition (1924) of this standard railway reference work is now at press. All previous Editions are out of print.

Locomotive Shed Indications, Southern Railway.

Several readers point out that our reply under this heading might be misleading, in that the explanation given applies more particularly to "Brighton" locomotives. In the case of those of the London and South Western Section, the letters indicate the power classification, "A" being the most powerful and "K" the least.

The classification is, we understand, as follows:—

(*a*) All 4-6-0 "Urie" engines, 6 ft. 7 in., 6 ft. 1 in., 5 ft. 7 in., and No. 335 rebuilt.
(*b*) All 4-6-0 four-cylinder "Drummond" engines.
(*c*) 0-6-0 goods, "Drummond" and "Adams."
(*d*) 4-4-0 large-boilered "Drummond," 6 ft. 7 in. driving wheels.
(*e*) 4-4-0 large-boilered "Drummond," 6 ft. 1 in. driving wheels.
(*f*) 4-4-0 mixed-traffic "Drummond," 5 ft. 7 in. driving wheels.
(*g*) 4-4-0 small-boilered "Drummond," 6 ft. 7 in. driving wheels (except Nos. 290-299).
(*h*) 4-4-0 small-boilered "Drummond," Nos. 290-299.
4-4-0, "Adams," 6 ft. 7 in. and 7 ft. 1 in.
(*i*) 0-4-2, "Adams," mixed-traffic.
(*j*) 0-4-4 T, "Drummond" and "Adams," 5 ft. 7 in. driving wheels.
(*k*) Old "Adams," 4-4-0 and 4-4-2 T—0-6-0 "Beattie" goods, mostly on duplicate list.

[Further reply to "Tauntonian" and R. A. Hardy.]

London Electric Railways.

Practically all the electric railways in the London area, except the Brighton Section of the Southern Railway, use direct current at 500–650 volts, though in a few instances rail return is employed, so that three rails only are used. Where there is a separate return rail (centre) the running rails are not used for return. Platelayers and others working on the line necessarily have to be careful that they do not touch the live rail, and it is desirable not to touch the negative rail, though, as a rule, that does not involve much danger. The great point is, however, that unless contact made between the positive rail and earth by anyone accidentally touching the former affords a better return than the negative or running rails, the severity of the shock is considerably mitigated. This depends on many factors. Hence, it is necessary to assume that it is always dangerous to make contact with the positive rail and desirable to treat the negative rail with care, or even to obey the injunction which appears on some warning-boards: "Do not step on any rail."

[Reply to A. Gillies.]

Route of Rosslare Boat Expresses.

In reply to your query, Mr. E. A. Neale, General Manager of the Great Southern

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and Western Railway, Ireland, kindly supplies the following information. During the period that the Rosslare boat expresses ran over the Dublin and South Eastern Railway's line between Waterford and Wexford North, they were worked by the Great Southern and Western Company's own locomotives throughout, with the assistance of pilot drivers. There are several "slows" between Wexford and Rosslare Harbour. From Wexford North to Wexford South the train travels over lines laid along the Quays which are not fenced in, and the speed has to be reduced to five miles per hour, occupying nine minutes. The speed is also reduced to five miles per hour over Coal Channel Bridge, and round the curves at the seaward end of Rosslare Pier, and to 15 miles per hour round the curves at the shore end. The average time occupied for the $9\frac{3}{4}$ miles was 27 minutes.

[Reply to J. A. DANE.]

Appearance of Locomotives.

While it is true that on most lines less attention is now paid to superficial elaboration, and one regrets the loss of the spick and span appearance which was once so general, this has to be attributed largely to the difference in conditions. Even now, however, we are inclined to the opinion that British locomotives will compare favourably in this respect with those in other countries, while some of the home lines have practically returned to pre-war methods. It does not follow that because an engine is not kept in a highly-polished and well-painted condition, the essential parts receive less attention than in former days, and instances of apparently ill-kept engines proving themselves to be in unsatisfactory working condition must merely be regarded as coincidences.

[Reply to C. C. H. HAWKEN.]

Gradient Boards on Austrian Railways.

We are indebted to Mr. C. H. Palmer for the following notes in reply to your query. The boards in question are the newer type of Austrian gradient boards. The larger figure gives the distance in metres of the gradient, the smaller the proportion per thousand (not one in something, as with us). If the larger figure be on top it is a down grade, and if the larger be underneath it is an up grade. If there be no small figure the track is level. Thus, $\frac{600}{3}$ indicates a down grade of 3 per thousand for 600 metres; $\overline{1080}$ means level for 1,080 metres; and $\frac{7}{3000}$ indicates an up grade of 7 per thousand for 3,000 metres.

[Reply to H. A. F.]

Railway Grouping.

In due course it will, no doubt, become practicable to refer to the various sections of the grouped railways in more convenient fashion, but while the different sections retain so much of the individuality of the component lines, the somewhat elaborate descriptions now required will continue to be necessary. Were we to indicate only the name of the group company, descriptions of illustrations and other references would become almost meaningless. If you have any suggestions for simpler means of reference, we shall be glad to consider them.

[Reply to "NORTHERNER."]

South to North Expresses.

You are correct in pointing out that the explanatory notes associated with the reproductions of three photographs by Mr. H. C. Doyne, on page 186 of the March number, appear to be contradictory in certain respects. The explanation is that these through services include trains from both the Great Western route *via* Birmingham and from the Great Central Section of the London and North Eastern Railway *via* Banbury and Woodford and Hinton, on some of which the Great Central engine works south to Oxford, if not further.

[Reply to S. HUMPHRIES.]

Extreme Loads of Strike Trains.

We are interested to note your remarks as to the loading, during the railway strike in January, of a Great Northern suburban train consisting of two articulated sets, 16 coaches in all, worked by a non-superheated 0-6-2 tank engine. Seeing that we have heard of nearly 2,000 passengers being conveyed in an 8-coach suburban set on another line, your estimate of 2,000 for this accommodation is probably below the facts. As this load was worked

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towards London, it was, no doubt, well within the capabilities of the engine.

[Reply to D. SHIRLEY.]

French Railways.

All railways in France, except the State lines, are owned and operated by private companies, though on much more restricted terms than in the case of British railway companies. Provision was made in early days for their being taken over by the State under certain conditions or if that policy proved desirable, which explains why the Western line was added to the original State system some years ago. The P.L.M. is a company line, as also the Nord, Est, Midi, and Paris-Orleans.

[Reply to C. THOMPSON.]

L.M.S.R. Locomotives.

We have no information as to any change of policy in regard to colours of passenger engines, and cannot, therefore, explain why the 2-4-0 and 4-4-0 locomotives you mention are still painted black. Your remarks as to other aspects of renumbering are noted. As far as possible, we hope to give some particulars as to occurrences in regard to individual engines, but, as already explained, to give details of all would take up much more space than we can spare.

[Reply to E. H. R. and others.]

Steam-heated Trains.

We have no knowledge that a different system has been adopted for heating six-wheeled suburban vehicles on the Brighton Section of the Southern Railway. It is not the universal practice to provide separate regulators for each compartment, particularly in the third class, and that may possibly explain the absence of the usual regulators in each compartment. Your remarks *re* " Brighton " 0-4-2 tanks are noted.

[Reply to C. THOMPSON.]

Southern Railway Services.

If you are unable to follow the exhaustive reply previously given as to train working in the Thanet district of Kent, you had better examine a time-table carefully. The standard route for traffic from London to Ramsgate and Margate is via Chatham and Faversham, though certain through carriages work to Margate Sands via Ashford. There are, of course, trains from London to Dover via Faversham and the old Chatham main line.

[Reply to " OWENORA."]

Colours of Locomotives.

You are correct in pointing out that a number of L.M.S. locomotives are appearing in liveries which do not agree with those which have been stated to have been adopted as standard, including passenger engines painted black and goods tank engines painted passenger red. We are not in a position, however, to indicate to what extent, if at all, the policy announced has been changed.

[Reply to H. E. IKIN.]

Coaching Stock, S.R.

Experiments of the kind indicated are frequently made by railways, so that the appearance of a long S.E. and C.R. bogie coach with 10 third-class compartments, with templates attached to represent a domed roof and additional width, probably indicated only one of various tests required to meet the conditions brought about by grouping.

[Reply to " WIMRAYNE."]

G.W.R. Locomotives.

As the " Castle " class 4-6-0 engines are engaged on principal main line duties, they all work to Paddington more or less regularly, whether stationed at Old Oak Common, Swindon, or elsewhere. The fact that the engines are still few in number probably explains why you have not been able to see any of them. Your further remarks are noted with interest.

[Reply to G. E. P. HORNBLOWER.]

The " Cornish Riviera " Express.

You will see from the records of runs of this train which have been published in Mr. Allen's articles from time to time, that it takes the Westbury route and therefore travels *via* Newbury. At most stations on the route it is safe to assume that the train is due to pass in a few minutes more than the number of miles from the starting point.

[Reply to E. A. LEVY.]

Exchange of Rolling-Stock on Irish Railways.

The use of Great Southern and Western coaches on Great Northern of Ireland expresses between Dublin and Belfast, and of Great Northern vehicles on Dublin

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and Cork trains, is due to the two companies having exchanged vehicles for comparing in each case with the owning company's stock used on the same duties.

[Reply to G. T. F.]

Double Lines Worked as Single.

The section of the Bedford-Northampton line mentioned by you is one of those which, originally laid with double track, has been adapted for single-line working. Presumably, the unused line is allowed to remain in view of possible use in the future, or because there has been no need or opportunity for removing it.

[Reply to J. L. SUTCLIFFE.]

Old N.E.R. 2-4-0 Locomotive.

No. 167, of which an illustration showing it rebuilt with a larger boiler, was given in the RAILWAY MAGAZINE dated February, 1918, was one of the old "Fletcher" type. Except for the fact that, as rebuilt, it had a rather larger boiler than usual, no special interest attaches to it. The engine was scrapped in 1920.

[Reply to L. G.]

Largest Railway Stations in the World.

On the basis of numbers of platforms, though not in regard to area, the six largest stations in the world are, we understand, as follows:—Grand Central Terminal, New York, 44; Pennsylvania Terminal, New York, 32; Union Station, Washington, 32; St. Lazare, Paris, 27; Waterloo, 21; Waverley, Edinburgh, 19.

[Reply to G. L.]

Catch Points.

Signs lettered "Catch Points," with a specified distance, indicate that at that distance catch points are located, and drivers of shunting trains must allow for this in any backing movement they may make. The points you have noted in the siding would be in the nature of trap and not catch points.

[Reply to B. B.]

Numbering of Locomotives.

Although the general tendency on all lines appears to be to adopt large numerals on the tank or tender sides, and in most cases goods engines are painted black, we cannot, of course, say definitely that this is to be the standard method in future on any particular railway or on all lines.

[Reply to "EUSTONIAN."]

G.W.R. 70-ft. Rolling Stock.

Necessarily, these large vehicles are not allowed to be worked on certain sections of the system. Reconstruction and other improvements have, however, reduced the limitations to some extent, but we cannot specify in detail the sections where these vehicles are prohibited.

[Reply to E. G. S. CHITTENDEN.]

"Prize Length."

Signs bearing these words are placed on the Great Eastern section of the London and North Eastern Railway to indicate that the permanent-way gang in charge has been awarded one of the prizes offered periodically for the best maintained lengths. [Reply to F. STAPLETON.]

L.N.E.R. (G.N. Section) 0-6-2 Tank Engines.

The engines you mention, now numbered 4751 N and 4731 N, belong to the present standard superheated passenger tank engines used in the London district, their previous numbers having been increased by 3,000.

[Reply to "SUBURBIA."]

Branch Line Working.

We cannot reply to queries as to classes of engines employed on individual branches unless they are sections for which special locomotive power is provided. The branch in question may be worked by any of the suitable tank engine classes available.

[Reply to S. MACTAVISH.]

Train Indicator in Box.

This indicator informs a driver held up at the signal that his train is protected by track circuit or otherwise so that it is not necessary for the fireman to go to the box as reminder to the signalman of the waiting train. [Reply to B. B.]

Jubilee of a Famous Locomotive Class.

You are correct in pointing out that "Stroudley" 0-4-2 tank engine, L.B. & S.C.R., was re-numbered 348 and not 349 as stated. The author of the article had already pointed out this typographical error.

[Reply to W. KEMP.]

Southern Railway (S.E. & C. Section) Locomotive Work.

Mr. Cecil J. Allen deals regularly with performance over these lines at

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least once annually, the last occasion being as recently as November, 1923, when a run was described with one of the trains you mention.

[Reply to LEONARD J. SLATTER.]

Redruth and Chacewater Railway.

This railway was described in the February, 1905, RAILWAY MAGAZINE. We have no recent information as to present conditions, but understand that the line is still in use for goods traffic, though not for passenger travel.

[Reply to T. G. RIMINGTON.]

The Blue Train.

Apparently, you refer to the train of new stock recently placed in service between Calais and the Riviera. The vehicles for this were constructed in England. For full particulars, with illustrations, see February, 1923, RAILWAY MAGAZINE.

[Reply to N. G.]

Southern Railway (L.S.W. Section) Locomotives.

The "736" class are the latest express passenger locomotives. Mr. Urie's latest design was, however, the 4-6-0 mixed-traffic series. We would remind you also of the rebuilds of various classes recently carried out. [Reply to W. L. W.]

Southern Railway (S.E. & C. Section) Speed Restrictions.

Speed restrictions affecting boat trains between Victoria and Dover by the usual route are 20 m.p.h. (down) and 25 m.p.h. (up) at Bickley Junction, and 35 m.p.h. through Tonbridge Junction.

[Reply to M. A. LINELL.]

"Southern Railway Magazine."

Originally the *South Western Railway Magazine*, this now serves the whole of the Southern Railway. Copies can be had from Waterloo or at principal stations on the Southern Railway.

[Reply to K. H. S. MASSEY.]

Northampton Loop, L.M.S.R.

Occasionally through expresses are diverted *via* Northampton, though scheduled to run *via* Blisworth and Weedon, to facilitate operation, though this is not usual with important passenger trains.

[Reply to "PERCONTATOR."]

Severn and Wye Joint Railway.

This line is operated generally by the smaller classes of both Midland and Great Western tank engines. It was described in detail and illustrated in the December, 1899, issue.

[Reply to "EX-FIREMAN."]

Wolverton Station, L.M.S.R.

We have no information as to why the location of the line at Wolverton was altered when the old station was replaced about 40 years ago by a newer structure on a different site.

[Reply to J. W. O. BULL.]

Great North of Scotland Main Line.

Main line of this section of the London and North Eastern Railway is double throughout from Aberdeen to the divergence of the Craigellachie and Coast Sections at Cairnie Junction.

[Reply to "VAUXHALL."]

Norwich (Victoria).

We know of no regular passenger service having been worked at any time between Yarmouth (Vauxhall) and Norwich (Victoria). It could not be done without reversing at Trowse Upper Junction.

[Reply to "VAUXHALL."]

Great Northern Locomotives.

There is no book which gives the works numbers and the dates of construction of all the engines of Mr. H. N. Gresley's design, and you may find some difficulty in getting this information.

[Reply to A. CRAVEN.]

Restaurant Cars on Scottish Railways.

Mr. C. L. H. Way points out that a Caledonian restaurant car is used for Highland services north of Inverness, and not a Pullman car, as stated in a previous reply.

[Further Reply to J. A. RANNIE.]

London-Manchester Expresses.

Trains not requiring to call at Stafford and travelling via Stoke, diverge from the main line at Colwick. If stopping at Stafford, the divergence is made at Norton Bridge.

[Reply to "OWENORA."]

Enfield-Stevenage Line, L.N.E.R.

June 2 is the date now announced for opening this line for passenger traffic. As you point out, goods trains have

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been using it during and since the war period.

[Reply to H. B.]

4-6-4 Tank Engines, L.M.S.R.

You are mistaken in thinking that there are ten of the "Tilbury" 4-6-4 tank engines. The total built was eight, so that Nos. 2108 and 2109 are blank.

[Reply to "TILBURY SECTION, L.M.S."]

West Coast Joint Stock.

Return working of the 1.30 p.m. ex Euston is the 1.30 p.m. up from Glasgow (Central), and its sections from other Scottish centres.

[Reply to "LONAMER."]

Great Western Railway Locomotives.

A number of rumours have reached us as to *The Great Bear* and other engines mentioned by you, but, so far, no authoritative information is available.

[Reply to H. ROBINSON and others.]

Tunnel at Golders Green.

Enquiry has been made, but we cannot understand what is meant by your reference to a third tunnel at Golders Green. Please explain further.

[Reply to HORACE S. HACK.]

Highland Railway Locomotives.

You are correct in pointing out that Highland 4-6-0 locomotive named *Thurso Castle* bears the number 27, and not 128, as recently stated.

[Reply to J. S. FROST.]

New 4-6-0 Locomotives, Southern (L.S.W. Section) Railway.

We hope to illustrate and describe the new series of 4-6-0 locomotives, including No. 473, in due course.

[Reply to R. S. JOHN and others.]

Southern Railway Locomotives.

No particulars available as yet as to numbering or section-indicating scheme for locomotives of the Southern Railway.

[Reply to A. J. AGLEN.]

L.N.E.R. York-Newcastle Main Line.

Work has not yet commenced on electrification of this route.

[Reply to W. E. BRIGGS.]

French Compound Locomotives, G.W.R.

We understand that all three of these engines are stationed at Oxford, working on various duties therefrom.

[Reply to F. E. WHITING.]

L.M.S. Locomotive Colours.

Goods engines in this group are to be painted in unlined black, as in Midland practice.

[Reply to J. S. TIBBITS.]

12.55 p.m. Leeds to London, L.M.S.

Route of this express on the non-stop run from Chesterfield to St. Pancras is via Trent and Leicester.

[Reply to A. O. BARKWAY.]

Austrian Railways.

An article was published in the April number in which the line you mention received attention.

[Reply to R. G. H.]

Great Western Railway Distances.

From Paddington to West Ealing, 6 miles 41 chains; to Burnham Beeches, 20 miles 77 chains.

[Reply to "COUNTY TANK."]

Canadian Pacific Railway.

All main lines in Canada and the United States have the standard gauge of 4 ft. 8½ in.

[Reply to D. M. G. CLARKE.]

Locomotive Workings.

We cannot undertake to give information as to the movements of individual engines.

[Reply to DESMOND F. ANDREWS.]

L.M.S. "Experiment" 4-6-0's, Western Division.

We know of no present intention to rebuild these engines with superheaters.

[Reply to H. S. TIBBITS.]

Conon and Cromarty Line, L.M.S.R. (Highland Section).

No information available as to progress with this projected line.

[Reply to A. MIALL.]

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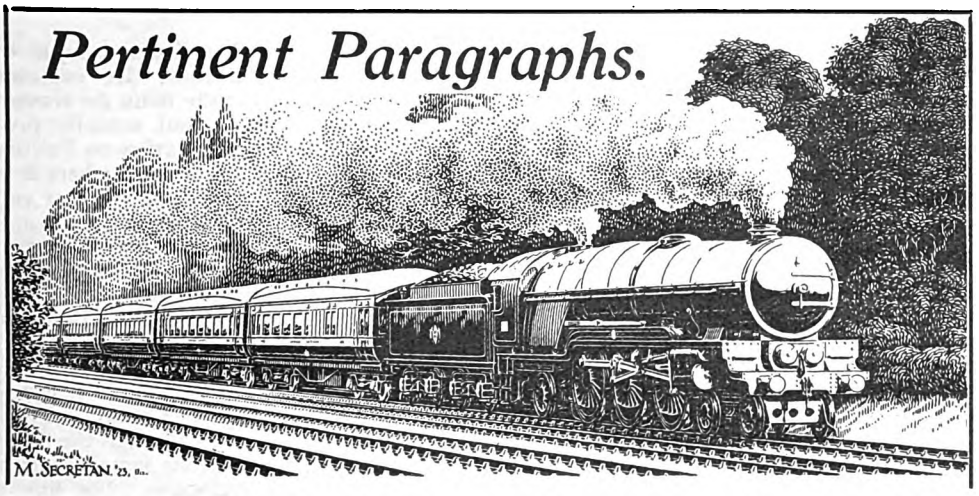
Pertinent Paragraphs.



Jubilee of a Famous Locomotive Class.

MR. J. N. MASKELYNE'S article in the March number dealing with the Stroudley 0-4-2 engines of the late London, Brighton and South Coast Railway, has attracted further correspondence, and a few remarks made by Mr. A. G. Williamson may be quoted as follows :—" When we consider how well they have lasted, it is interesting to compare them with what was being built for similar work on neighbouring lines in the early 'seventies. It will then be appreciated how much in advance of their contemporaries they were. Take the cab alone. This has remained as standard practically unaltered till the present time. The wearing parts of the engine were well designed for their work, and the simplicity of the motion was in advance of the current practice. Most of Stroudley's engines had a greater power to weight ratio than others of the period, and yet they have lasted better than most. His latest 'Gladstones' were lighter than his first much less powerful class of 2-4-0 express engine. These latter, though handsome machines, always seemed to me to be unnecessarily heavy and cumbersome. Whether Stroudley employed mathematics for designing his parts or not I do not know, but he must have possessed a wonderful power of visualising the requirements of those parts which bear the most strain. Such parts were designed large and heavy, yet as a whole his engines were extremely light. The most remarkable thing is, I think, that the D1 class were designed to use a hand-brake, and a low boiler pressure, and yet they stand up to the Westinghouse brake and modern pressures with scarcely any modifications whatever. Excellent though the Brighton were, and despite the extreme care with which they were constructed, it is, I think, generally held that the Neilson's were better. (I can hear your Scottish readers saying 'Of course.') "

Locomotive Gymnastics.

" THERE was one thing about Stroudley's engines which I could never fathom ; perhaps some of your readers can enlighten me. They sometimes gave one that slight stomach pump feeling which was so pronounced with Webb's three-cylinder compounds. The E1 tanks were particular offenders in this respect. In some cases it may have been due to temporarily incorrectly-set valves. But I have often thought it to be due to excessive compression, possibly caused by the provision of inside lap. At other times I have wondered whether it was due to the balancing. His engines appear to be balanced separately for the right- and left-hand cranks, and not as is the modern practice considering the right- and left-hand engines together and employing a resultant weight. When a 'Splugen' class was piloting a 'Gladstone' or a single I have observed the engines to be buffing each other at quite a considerable speed. If anyone can suggest a cause I shall be glad to hear it. Another matter that I do not recollect ever seeing mentioned in print was the use about a quarter of a century ago of a 'Terrier' which used to run down from the East London line to Croydon and bring up the London Bridge portion of the evening boat train. I never had an opportunity of timing one of these runs, but it would be interesting if one of your readers could supply a log of a run of so long ago and probably forgotten working. A 'Terrier's' speed down the New Cross bank on an express train would probably make interesting reading. Coming back to the D1 tanks again I notice that at least one of them, No. 258, has been fitted with new wheels in

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which the balance weights are on the same centres as the coupling rods, which is the reverse to Stroudley's invariable practice. Although in print I always see Stroudley's D1 and A classes referred to as 'Bulldogs' and 'Terriers' respectively, yet 25 years ago at New Cross they were always called 'Ironclads' and 'Rooters,' though I am not sure how to spell the latter word."

Grouping Changes in South Wales.

MR. W. T. PHILLIPS, an old reader who lived in Barry for many years, sends some notes in regard to traffic methods and conditions in South Wales, including changes which have resulted from grouping. He points out that effects of grouping are to be plainly seen on the various South Wales railways, all of which are now absorbed by the Great Western Railway. "Some weeks ago I was at Barry (and I may say that I have a first-hand knowledge of traffic working on the *ex* Barry Railway), and amongst other changes that I noticed the following may be of some interest. Most of the *ex* Barry passenger stock is now painted in the new Great Western Railway standard colours, and a few of the sets have been fitted with steam heaters; the set so fitted in which I travelled was on the Vale of Glamorgan section. Some of the 2-4-2 and 0-4-4 passenger engines have been painted green and renumbered, but they still retain their large brass domes and other Barry characteristics. Several of the 0-6-2 mixed traffic engines have been rebuilt with Great Western Railway boilers with domes, whilst a few of the 0-6-4 mineral engines have now been rebuilt with the latest type of Swindon boilers and mountings. A number of Great Western Railway 2-6-2 passenger tank engines are working passenger trains on the Barry-Cardiff line, and a Great Western Railway 2-4-2 tank is partly working the passenger service on the Vale of Glamorgan section, Barry to Bridgend. It is interesting to note that *ex* Barry engines, Nos. 21 (2-4-2) and 22 (the rebuilt 2-4-0 mentioned in Mr. Ahrons' article on the Barry Railway), are still in service and are often worked on passenger trains between Barry and Cardiff, and sometimes on the Barry and Porth section. It is quite usual for them to haul heavy 10-coach trains in the summer months, stopping at all stations, between Barry Island and Cardiff, and, what is more, they usually keep time on the turn."

French Railway Station and Train Working.

COMMENTING upon "Dieppe's" remarks, quoted in the March number, Mr. D. Graham Davis sends a few further observations on the Barentin-Caudebec-en-Caux branch of the French State Railways. He explains that this branch leaves the main Le Havre-Rouen line at Barentin, but actually proceeds away from its destination to Pavilly (a distance of some 4 kilometres), where it is served by a platform slightly to the east and nearer to the town than the main station. Here the engine is turned and the train starts on its journey proper. Leaving the line from Barentin on the west, it proceeds down a long falling gradient to the Barentin viaduct, under which it passes calling at Barentin-Ville station. Thence the line is fairly level and straight to Yainville, where a sharp turn to the north-west occurs. From here onwards the line runs through the Seine Valley and the passenger has some beautiful views of river and landscape. The line is about 30 kilometres in length and the journey takes (or took in 1922) some 2½ hours.

Recollections of Crewe.

COMMENTING upon Mr. J. G. B. Sams' article, of which the first instalment was published last month and the remainder elsewhere in the present issue, Mr. E. B. Hall adds some comments, which may be reproduced: "This is the period (1897-1902) when I knew the London and North Western Railway best, and it is, I consider, the most interesting period in all its history. What glorious memories the old names of three-cylinder compounds and 7 ft. 6 in. singles—the 'Highflyers,' as many called them—conjure up! There is no doubt that the names of locomotives add a very great interest to them. It is very much to be regretted that they are being discarded and that the old romance attaching to locomotives is discountenanced. Personally, I should never have been attracted so intensely to the London and North Western Railway in the first place had it not been for the fascinating, and in many cases, romantic names of the locomotives. Since 1895 I have travelled all over the system with the sole object of seeing, and in more recent years, of photographing particular named engines which I could not discover except by special expeditions to their local haunts. For example, only a year ago I visited the neighbourhood of Penrith on purpose to see the old 6-ft. 'Jumbo,' *Marquis Douro*, which for many years has been stationed at Workington and has not left this district except for periodical visits to the works. Again, I went to Bangor to find another of the same class, *Theorem*. A month or two ago a question was asked about *Hardwicke*, 790. She is 'still running' and during the summer of 1922, when with five other 'Jumbos' she was stationed at Camden, I frequently saw her piloting

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expresses between Euston and Crewe. Several times she appeared on 'the Corridor.' *Perseverance*, 2180, the last of the famous trio, was there last summer on the same work, but usually big engines are employed now for piloting."

The "Teutonics."

"MAY I point out that Mr. Sams is wrong in saying, on p. 272, that the ten 7-ft. compounds 2-2-2-0 were known as 'Adriatics.' They were known as 'Teutonics,' after No. 1301, and *Adriatic* herself was 1309. I have a photo before me of her as she ran in the Race of 1895. *Jeanie Deans* of this class was my favourite engine on the system, and many are the times I have seen her on the old 'Corridor.'"

In regard to Mr. Hall's letter, Mr. Sams remarks as follows: "He is quite right about the 7-ft. 2-2-2-0 compounds; they were known as 'Teutonics.' I regret the error. I, too, am sorry about the disappearance of names from locomotives, having always considered that they had a good advertising value for their railway—perhaps as much as posters designed by eminent artists. The first cost of the old London and North Western Railway name-plates was not very much, and they were certainly permanent. Talking about No. 790, *Hardwicke*, I assisted to put a new pair of cylinders into her about 1900, the old ones having failed in an extraordinary manner, just as if a bomb had been exploded in the V-shaped steam-chest and blown the top of the cylinders and chest, also the base of the blastpipe, practically to smithereens. I never heard any details or even a suggested cause; she just appeared on the 'Bank' outside for repairs and was passed into the shop in the ordinary way. She was the last 6-ft. 6-in. 'Jumbo' to have black side rods."

"Jumbos" and other Old Engines.

IN a further communication Mr. Hall writes: "In connection with the 'Jumbos' on the London and North Western Railway, I might mention that at present there are no less than ten at Bletchley shed, eight 6-ft. 6-in. and two 6-ft.—one the well-known *Sister Dora*, No. 2158, formerly *Serpent*, and the other the last of the 90 6-ft.'s, namely, *Cuckoo*, No. 1168. Both these engines were at Camden throughout the summer of 1922, and were piloting long-distance expresses almost every day. Then, in October, they graduated to Bletchley—which is frequently the case—and have been there ever since. Possibly they have gone to the Works now, as it is six weeks since I saw them myself. One of the latest comers is No. 2180, *Perseverance*, which was piloting from Camden shed all last summer.

"Mr. Sams might have mentioned the extraordinary exhaust note of the three-cylinder compounds when the big low-pressure cylinders began to function. The beat of this dominated all other sounds, and I have frequently been able to decide quite definitely the type of engine on an approaching train, even at a distance of 2 miles or so—more on a still day. It was a most fascinating sound to me! And the prettiest sight imaginable was to see a 7-ft. 6-in. and a 'Teutonic' together at speed. The 'Teutonics,' in spite of their small size from a modern standpoint, always gave an impression of power and a certain massiveness combined with beauty; more so than any other North Western engines of the 1900 period."

A Light Engine Collision.

ON December 16 last, at Long Dyke, Cardiff, Great Western Railway, the 1 a.m. Bristol to Cardiff express, with all signals clear, worked by 4-4-0 locomotive No. 4133, came into collision with 2-6-0 engine No. 5394, which, after working a special cattle train from Fishguard, was on its way light to the engine shed. Both engines were partially derailed and some damage was done to the leading vehicle of the express. The fireman of the light engine and both of the express enginemen suffered from cuts and bruises, but there were complaints of bruises sustained by only two of the 24 passengers in the express. This collision, due to a signalman's forgetfulness, had features similar to other accidents in the past, *e.g.*, Hawes Junction, when signalmen have failed to remember the position of light engines standing on main lines within their control. Owing, however, to the fact that the express train was within three-quarters of a mile of its destination (Cardiff station) and was, therefore, running at reduced speed, the casualty list was fortunately much smaller than has frequently been the case.

Colonel Pringle's report on the accident places the main responsibility upon signalman Deeley. He had means available—lever collar and instrument flap—for reminding himself of the position of the light engine. In accordance with Rule 55 (*f*) he should have made prompt use of these appliances, since he was not in a position to offer the light engine to the signal box in advance. He failed to obey the rule, was busied with other work, forgot the position of the engine and thereby caused the accident. Deeley is spoken of most highly by his superior officers, and gave his evidence in a straightforward manner.

The action of the men on the light engine was also criticised in so far as they failed to carry out Clauses (*a*) and (*f*) of Rule 55.

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While Colonel Pringle does not excuse driver Jenkins and fireman Underwood from failure in respect of their delay in carrying out Rule 55, "there are certain features which perhaps may have influenced their action, and it is clear that they had the interests of the service at heart." He is inclined, therefore, to regard their failure rather as an error of judgment than a wilful neglect of the rule. Both men bear excellent characters. In the course of the enquiry the point was raised as to which of two signal boxes was the one to which the fireman should have gone. On this point Colonel Pringle expresses the decided opinion that there can be no doubt that the box in question must be that from which the signals concerned are worked. After reviewing the circumstances of the location, the installation of track circuit is recommended, though the place concerned was not one where such protection would ordinarily be regarded as necessary. The inspector mentions also that the provision of track circuit on the Great Western system generally is at present receiving full consideration.

Grassington Branch, L.M.S.R.

SUPPLEMENTING the reply given under this heading in "The Why and the Wherefore" section in the April number, Mr. Harold Smith, writing from Skipton, sends some remarks which go far to explain this matter. He points out that the 7.58 a.m. up train from Embsay is a through train from Grassington (7.33 a.m.) to Bradford, via Ilkley, and also has a through portion for Skipton, being divided at Embsay junction (about 25 chains west of Embsay station). The junction is not a triangle, so the Ilkley and Bradford portion has to reverse, there being a cross-over road, the engine (generally a 0-4-4 tank) having previously arrived "light" from Skipton. There is no corresponding down service, Grassington being served by a "shuttle" train from Skipton, generally worked by a 0-6-0 goods engine, No. 2502, a sturdy old veteran with outside springs, doing duty at present.

"The connections at Ilkley are rather interesting. The Grassington train arrives at 8.21, going forward at 8.30 as a fast train stopping at the Wharfedale stations of Ben Rhydding and Burley and thence non-stop to Shipley, the arrival time at Bradford being 9.3. In the meantime another fast Bradford train leaves Ilkley at 8.24, misses Ben Rhydding and Burley, stops at Menston and Guiseley, and runs thence non-stop, arriving at 8.52.

Connections at Ilkley.

"IT is possible to save ten minutes by changing at Ilkley, providing the passenger has no luggage and is well-versed in the geography of Ilkley station, but the connection is not shown in the time-tables. Leeds passengers go forward by a fast train at 8.55, arriving 9.20. The next train inquired about, which arrived at Ilkley 9.2, is a through train Skipton to Leeds, leaving Skipton at 8.33. It goes forward from Ilkley at 9.15, making a connection with an Ilkley to Bradford fast train at 9.9. This latter is the fastest up train to Bradford from Ilkley, running non-stop from Ben Rhydding and arriving 9.33. The arrival time at Leeds is 9.54. Passengers from Skipton to Leeds or Bradford do not, of course, go by this route, there being an excellent service via Keighley—the main line. For example, the morning residential express leaving Morecambe at 7.42 arrives at Skipton at 8.43, and is there divided, the front portion leaving at 8.45 and running non-stop to Bradford—arrive 9.15. (A connecting train leaves Grassington at 8.3, half-an-hour later than the through train via Ilkley, whilst the arrival time at Bradford is only 12 mins. later.) The Leeds portion of the Morecambe train arrives at 9.28—26 mins. in front of the 8.33 ex Skipton via Ilkley!"

Ilkley as a Railway Centre.

"So far as Ilkley is concerned the London Midland and Scottish local services are extraordinarily good, there being a really excellent series of fast trains to Leeds and Bradford, whilst the London and North Eastern Railway local trains are quite satisfactory. But there is considerable dissatisfaction in Ilkley with the entire absence of main line trains. Although not so aristocratic as its neighbour Harrogate, nor possessing Harrogate's wonderful baths, Ilkley is superior to Harrogate in scenic beauty; and its development, rapid as it has been during the past few years, would be still further accelerated by a through service from London and the big Midland towns. The line through Ilkley forms a loop to the Scottish main line of the London Midland and Scottish Railway, and although the gradients are fearsome and the curves serpentine—still it is not an impossible route for a light train, and it does not seem unreasonable to suggest that one of the daylight Edinburgh trains might be diverted via Ilkley—I often see them with only five coaches between Leeds and Hellifield. Some 16 or 17 years ago—I forget the exact year—there was a summer-time, Saturdays only St. Pancras-Edinburgh train via Ilkley; and I can remember the whole of the Scotch traffic running this way one Monday morning some twenty years ago, owing to the collapse of a road bridge at Apperley during

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Sunday morning repairs. At the least, however, a through carriage daily might be given to Ilkley. The London and North Eastern Railway provide the fastest timing between London and Ilkley—4 hr. 38 min. by the 1.30 ex King's Cross via Holbeck—but a vast improvement could be effected by running some of the Ilkley trains into the Central Station at Leeds, if room could be found for them. If the 2.53 out of Leeds (New) were to start from Leeds (Central) it would connect with the Harrogate Pullman which arrives at 2.40. No particular connections are made at Leeds (New) that I am aware of. At present the 2.53 is shown as connecting with the

Photo.] [*Topical.*

DEMONSTRATION OF GEARLOCK-REYNARD AUTOMATIC COUPLING AT LANCING.

10.10 a.m. ex King's Cross at Holbeck, whilst the 'Pullman' does not leave for another hour—11.15."

The Gearlock-Reynard Automatic Coupling.

THREE years have elapsed since Mr. W. G. Boonzaier, the South African inventor, made a public trial of his automatic coupling at Clapham Junction. Much has happened in reference to the coupling since then, including the lamented demise in October last of the inventor. In the interim, however, Mr. Boonzaier had not been idle, but had devoted further considerable thought to his device, with the result that just before his death he had improved it in many respects. On Thursday, March 27, by kind permission of the Southern Railway Company and at the instance of the British & Colonial Inventions Ltd., of 118, Queen Victoria Street, E.C. 4, a demonstration of the coupling was held at Lancing, near Brighton. At lunch, Mr. Gordon Cumming, managing director of British & Colonial Inventions Ltd., in welcoming the guests, expressed his regret that owing to pressure of work Sir Herbert Walker and Sir William Forbes and the Right Hon. J. H. Thomas, Colonial Secretary, were unable to be present on that occasion. Proceeding, he expressed his acknowledgments to the Southern Railway authorities for having afforded facilities for the forthcoming demonstration and the help rendered by the company's officers to himself and colleagues. After a graceful reference to the late Mr. Boonzaier and the work he had put in on the coupler, the speaker observed, with conviction, "I feel confident that we have the goods."

Subsequently the party proceeded to Lancing, where, under the direction of Mr. G. H. Gardener, manager of the carriage and wagon works there, a series of exhaustive tests lasting several hours were made. In this connection valuable help was also rendered by Mr. Cumming, Mr. Sidney Hartley and Mr. G. Boonzaier (son of the inventor). The coupling performed all the functions attributed to it and coupled as successfully on the curve as on the straight,

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and was uncoupled with ease whether stationary or in motion. Its safety in handling greatly impressed the onlookers—who, by the by, included Mr. J. Scott Main, Secretary of the Railway Safety Appliances, Ministry of Transport, and Mr. T. H. Hyman, Superintendent, Car Shops, Montreal, Canadian National Railways, who attended, we understand, at the special instance of Sir Henry Thornton. The "Gearlock" draft coupling is composed of three working parts—a head, a pinion and a pawl—and its general construction will be seen from the photograph. The "Reynard" under coupling connects up the pipe connections simultaneously with and under control of the gearlock. The action of coupling-up is automatically performed by the buffer head of one coupling member rising into the concave buffer of the opposite member, causing the pinions to rotate inwardly (away from the jaws of the pawls), whereby the engaging tooth of one passes over that of the other, and the pinions meanwhile being prevented from rotating outwardly (returning against the jaws of the pawls), a secure coupling lock is effected.

The coupling is simple in design and construction, safe in operation, and weighs approximately 6 cwt. per wagon, *i.e.*, two sets, as compared with an average weight of 12 cwt. per wagon under the hook and link method at present employed on British railways.

The Inland Exeter—Newton Abbot Route.

THE subject of an alternative route for the Great Western Railway between Exeter and Newton Abbot, to avoid the coast section, which upon occasions has been blocked by falls of rock, mentioned in the March number of the RAILWAY MAGAZINE, has attracted several letters from readers. Mr. D. A. Beckett, writing from Exeter, says:—

"Only the trains to Plymouth and Cornwall were sent via the Southern Railway, and the trains to Torquay and Dartmouth were actually worked over the Teign Valley branch. Expresses serving both districts were split at Exeter instead of Newton Abbot. The branch is, as you mention, single line throughout, and only one intermediate station, Christow, has two platforms, though trains could also pass at Trusham, where there is a good loop. Further, I have been told that on this occasion main line engines were not run over the branch, but that the 'Torbay Limited' and other heavy trains were double-headed with small tank engines. Probably the underline bridges are not fitted to carry a heavier weight, and this is the more likely since the line was originally constructed by a small local company who were short of funds, the contractors having to accept part payment in shares. One bridge over the River Teign, near Heathfield, was reconstructed a year or so ago with much heavier girders, but, of course, there are many others. Incidentally, on that occasion a large steam crane employed on the work overran the mark and fell in the river.

"I may add that sharp curves abound on the line, several being of only 10 chains radius. There is a gradient of about 4 miles of 1 in 56 and 1 in 58 up to the summit at Longdown station, broken only by a short level piece through Ide station. The descent to the Teign Valley at Christow is by some three miles of 1 in 64. The line then descends the Teign Valley with gradients of chiefly 1 in 200 to 300."

"G. R. O.," who resides in the district, remarks that, recently the up Teignmouth-Dawlish line was blocked by a fall of cliff, and then up traffic was diverted via Heathfield to St. Davids. "I understand that only light tank engines can use the Teign Valley branch, owing to the sharpness of the curves and much time was lost, as Christow and Trusham are the only stations where trains can pass each other. I have also heard that the Great Western Railway may eventually double the Exeter and Teign Valley branch and construct a new railway west of Heathfield to Bickington and Ashburton, joining the main line near Totnes. It is supposed that this would be shorter than via Newton Abbot. The doubling of the Exeter Railway would necessitate the boring of two tunnels near Longdown."

Heathfield's Peculiar Junction.

A LETTER from Mr. J. Brander, of Bristol, sheds light on the peculiar nature of the junction at Heathfield, which seems to explain the use of two engines with a long train, and why the "Cornish Riviera Limited" and similar trains do not utilise this route when the coast line is blocked. According to a sketch plan submitted by Mr. Brander, although the junction at Heathfield is laid in a direction that should ensure a straight run through between Exeter and Newton Abbot and *vice versa*, that is not possible, as down trains over the Exeter Railway, after arriving at Heathfield Station, have to set back into a dead-end siding and then start forward again to join the Teign Valley line to Newton Abbot.

The length of this spur beyond the points leading to the Moretonhampstead line determines the length of train that can be worked through without uncoupling. Mr. Brander says:—

"Heathfield Junction is a one semi-island platform station, both lines are single except at some passing stations, the Ashton and

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Exeter trains run into a short dead end, holding at the most 6 'eights.' Passengers alight and walk across the platform to join the Newton-Moretonhampstead trains. The train could shunt back up the spur and then draw forward to the other side of the platform, but in the ordinary course of events there is no through traffic. I remember once or twice going through from Newton Abbot to Chudleigh with school treats, but the train had to be limited to the length of the platform dead end at Heathfield. The down 'Limited' could be worked through by splitting and shunting in several portions, incidentally reversing the relative positions of some of the coaches, but the up 'Limited' would not manage at all."

From the above we gather that there is no means for the engine to run around the portions of the up train on the Chudleigh line at Heathfield. Possibly the utilisation of two engines on the "Torbay Limited," mentioned by Mr. Beckett, assisted materially in reforming the train after the transfer from the Teign Valley branch to the Moretonhampstead branch at Heathfield. It would be of interest to know why the peculiar junction between these two lines was made at Heathfield (originally Chudleigh Road). Probably the jealous feud between the South Devon and Moretonhampstead Railways and the Teign Valley Railway (sanctioned in 1863 and not opened until October, 1882) supplies, in part, the reason.

Observations on Swiss Railways.

COMMENTING upon Mr. J. I. Pearse's article in the March number, Mr. H. E. Underwoolf, writing from Geneva, points out that: "Speaking of the Lötschberg Railway, Mr. Pearse says 'From Berne to Spiez the line is double, but beyond Spiez all three routes have one track only.' This is correct for the Interlaken and Zweisimmen branches, but the main line, that from Spiez to Brigue, has two tracks between Kandersteg and Goppenstein—that is to say, throughout the great Lötschberg tunnel. The whole line, moreover, is prepared for two tracks, signals being placed at some distance from the line to permit of the laying of the second track, and many of the shorter tunnels having been made wide enough, from the first, for a double-track line." In reply Mr. Pearse remarks that while it is true there are two tracks between Kandersteg and Goppenstein, it does not alter the fact that after leaving Spiez the three routes have one track only. On the main line there is one track only as far as Kandersteg, a distance of 44 milometres.

In regard to types of locomotives in use, Mr. Underwoolf points out, and Mr. Pearse agrees, that those employed on the Lötschberg line only were particularly considered. As the former points out, on the electrified lines of the Swiss Federal Railways the principal types are: 2-4-4-2, 4-6-2, 2-6-2 and 2-6-6-2, as set forth in the following table kindly supplied by him :—

SWISS FEDERAL RAILWAYS.

—	Type.	Max. speed in kilom.	Date of construction.	Number of locomotives.
Passenger service ..	2–4–4–2	75	1919–23	41
	4–6–2	90	1923–24	20
	4–6–2	90	1921–23	16
	2–6–2	90	1922–23	14
	2–4–2–4–2	75	1921	6
	2–4–4–4–2	90	1922	1
	2–4–4–2	75	1919	1
	2–6–2	75	1919	1
Goods service ..	2–6–6–2	65	1920	1
	2–6–6–2	65	1920–22	33
Shunting ..	2–6–0	40	1923	2

Alternating single-phase current, 15,000 volts.

SWISS FEDERAL RAILWAYS.
Simplon Line (Sion-Tielle).

Type.	Maximum speed (km.).	Date.	No.
2–6–2	80	1906	2
4–4	80	1907–19	4
2–8–2	65	1914	1

Alternating three-phase current, 3,000 volts.

Another point raised by Mr. Underwoolf is that "the Lötschberg Railway does not connect at Berne, but at Thun, with the Federal system. The main line from Berne to Thun belongs to the Federal Railways. There is a small branch line, it is true, from Berne to Thun, which is worked by the Lötschberg Company, but it is only a local line, single track throughout." Mr. Pearse states that "it would be more correct to say that the B.L.S. Railway connects with the Federal system at both Berne and Thun, although the main line does so at Thun. What I intended to convey was, that as the B.L.S. Railway does work into Berne, as Mr. Underwoolf admits, that place may be considered the furthest point to which the railway runs. With regard to main-line

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trains, engines appear to be always changed at Thun."

With reference to the Montreux-Oberland Railway, Mr. Underwoolf explains that "trains have frequently, in the summer months, five or six coaches, beside two motor-cars and one or two goods wagons. Goods trains are not frequent on this line, but I remember seeing one composed of thirteen covered wagons and three motors (two in front and one behind); rather a surprising train to find on a narrow-gauge single-track line with gradients of 7·3 per cent. In the summer season, there are three dining car services a day, each way. In regard to these remarks, Mr. Pearse explains that although he saw a few trains with six or more vehicles, it appeared to him that the average was about four. "I can quite believe that it would be possible to work longer trains on this line if found necessary, as on the Bernese-Oberland Railway, as mentioned on page 181 of your March issue. I travelled in a train consisting of 12 vehicles, with two engines, up gradients steeper than are to be found on the M.O.B."

London and North Eastern Railway Musical Society.

THE 124th concert, concluding the 16th season of the society, held on Saturday, March 29, at Queen's Hall, was in some respects the most successful of any which the society has held since its inauguration as the Great Eastern Railway Musical Society in 1908. The hall was crowded with an enthusiastic and keenly appreciative audience, while the programme was carried through in magnificent style. The orchestra, numbering about 100, rendered in splendid fashion Schubert's Overture to "Rosamunde," Sir Edward Elgar's extremely difficult transcription of Bach's Organ Fantasia and Fugue in C Minor, F. Rosse's "Doge's March," from "The Merchant of Venice," and Tschaikowsky's "1812" Overture. The last-mentioned was conducted by Dr. Adrian C. Boult. The soloists were Mr. Charles Knowles and Miss Lilian Davies, both of whom were in some instances accompanied by orchestra. Full credit must also be given to the combined Male Voice Choir, including contingents from Cambridge, Grimsby, Ipswich, King's Lynn, London, Norwich and York to the number of 280. Certain items included accompaniments, but the choir is especially to be complimented upon its renderings of unaccompanied part songs, deserved encores being called for in one or two instances. The choir joined with orchestra and soloists in several items.

The chair was occupied by Mr. William Whitelaw, Chairman of the L.N.E.R., and among others present were the following:—Directors: Lord Faringdon, C.H., Deputy Chairman; Mr. H. T. Bailey and Mr. W. B. Gair. Chief Officers, L.N.E.R.: Messrs. R. L. Wedgwood, C.B., C.M.G., S. A. Parnwell, E. A. Clear, J. McLaren, G. F. Thurston, C. J. Brown, J. Miller, G. Marshall, A. J. Brickwell, C. L. Edwards, Colonel H. H. Mauldin, L. Sydney Smith, E. L. Hawkins, S. L. Murgatroyd, J. Proctor Smith, C. H. Newton, W. M. Teasdale, P. Syder, W. Gracie, and L. Brightman. Visitors from other railways, &c., included the following:—L.M. and S.R.: Messrs. A. Eddy, F. G. Evans, C.B.E., J. Quirey, C. Graseman. G.W.R.: Mr. R. Cope. Metropolitan Railway: Mr. W. M. Ballingall. Underground Railways: Mr. J. C. Mitchell. Railway Clearing House: Mr. P. H. Price. Ministry of Transport: Mr. W. V. Wood. Institute of Transport: Mr. A. Winter Gray. Together with Mr. F. H. Seale, of Price, Waterhouse & Co.; Mr. F. A. Sargent, late L.N.W.R.; and Mr. H. G. Drury, late Superintendent of the Line, Great Eastern Railway.

During an interval, Lord Faringdon expressed, in a few well-chosen words, appreciation of the presence of Mr. Whitelaw that evening, and recognition by all concerned of the great debt which everyone acknowledges to Colonel Galloway, who has been Hon. Conductor throughout and who, so far, has never missed a single public performance of the society.

Mr. Whitelaw, replying from the platform, was accorded full musical honours. Thanking Lord Faringdon for his remarks, Mr. Whitelaw suggested that, so far, he had not come across anything in the musical line which the society could not carry out successfully. Already it included contingents from sections of the L.N.E.R. system as far north as York, and was gradually extending its activities still farther. Adding some kindly remarks concerning the time and trouble taken by choirs, orchestra, Colonel Galloway and those who worked with him, he concluded with the humorous comment that "If you Englishmen were as familiar with the Bible as we Scotsmen, you would use the words of the prophet Daniel and say of Colonel Galloway, 'O King, live for ever.'" Arrangements were in the hands of the Concert Committee, under the chairmanship of Mr. P. Syder, and Mr. A. W. Headley, Hon. Orchestral and General Secretary, with other officers of the society. Mr. E. A. Lambert rendered valuable service as Hon. Ticket Secretary. Mr. W. M. Teasdale, with Mr. E. A. Evans and their assistants, were in charge of press matters.

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WHAT THE RAILWAYS ARE DOING.

Mr. Arthur Morton Bell, C.B.E., M.I.M.E., Carriage and Wagon Superintendent, Great Indian Peninsula Railway, having proceeded on leave prior to retirement, Mr. Leslie Flatt, B.Sc. (Lond.), A.M. Inst.C.E., &c., has been appointed to act in his stead. Mr. Bell began railway life in 1881 as an apprentice in the locomotive shops at the Stratford Works of the Great Eastern Railway. Mr. Bell was awarded a diploma and medal at the Paris Exhibition of 1900 for his co-operation in the design of the oil-burning arrangements fitted to Mr. Holden's 4-4-0 locomotive No. 1900, "Claud Hamilton," exhibited by the Great Eastern Railway. At this time Mr. Bell was also in charge of the wagon shops at Temple Mills. After 21 years with the Great Eastern Railway, Mr. Bell joined the Shell Transport Company as a mechanical engineer and oil fuel expert. On January 1, 1904, he was appointed Carriage and Wagon Superintendent of the Great Indian Peninsula Railway. His first duty was organising a new department, as it had been decided that the Carriage and Wagon should be separate from the Locomotive Department. Additional staff had to be selected, workshops rendered self-contained, and new rolling-stock designed and constructed. Entirely new shops were built at Matunga, Bombay. Nearly every type of rolling-stock on the Great Indian Peninsula has undergone re-design and improvement during Mr. Bell's term of office; handsome vestibuled corridor trains, restaurant, sleeping and military cars have been introduced. The partiality of the Great Indian Peninsula for "high capacity" goods stock is to be largely attributed to Mr. Bell's efforts, he being an enthusiastic advocate for heavier trains on the broad-gauge railways. Steel passenger coaches, too, have received his strong support. Very few heads of departments on Indian railways are appointed direct, and now, owing to the reorganisation of the administration and eventual merging of the carriage and wagon department into that of the chief mechanical engineer, Mr. Bell will have the experience of being the first and last of his grade. He is a member of the Institute of Mechanical Engineers, and of the Institution of Locomotive Engineers. Mr. Bell has had the satisfaction of seeing the question of the adoption of mechanical couplers practically decided on by the Railway Board, a reform of which he has been a pronounced advocate; further, his unceasing efforts to get the continuous brakes used on all goods trains of the broad-gauge railways are about to be rewarded with success, April 1, 1925, being the date now agreed upon.

MR. A. M. BELL,

Carriage and Wagon Superintendent, Great Indian Peninsula Railway, 1904–24.

* * *

Mr. H. Marriott, C.B.E., Assistant to the General Manager, London Midland & Scottish Railway, who retired at the end of

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March, has been appointed Reporter to the International Railway Congress next year on methods of establishing light railways in developing new countries and will, it is understood, continue to act for the London Midland & Scottish Railway on matters relating to that Congress.

* * *

By the recent death of Mr. Ammon Beasley, who retired from the position of General Manager of the Taff Vale Railway in 1917—he was born in 1838—the famous "Taff Vale judgment," following the strike on the Taff Vale Railway in 1900, is re-called. The directors, acting upon the advice of Mr. Beasley, sought an injunction against the Amalgamated Society of Railway Servants, now included in the National Union of Railwaymen. This injunction was granted, reversed by the Court of Appeal, and confirmed by the House of Lords in 1901, who decided that a trade union was capable of being sued; and restrained the A.S.R.S. from picketing and violence to employees who remained at work. As a result of this decision the railway recovered £24,000 damages from the railwaymen's union in respect of the strike. The law following this judgment was altered by the Trade Disputes Act, 1906, which enacts that no trade union, or trade union official acting as such, can be sued in respect of any action taken in furtherance of a trade dispute.

* * *

On Monday, May 5, Mr. Cecil J. Allen, President of the Railway Club, is booked to speak at the London Broadcasting Station at 9.15 p.m., his subject being "On the Locomotive Footplate." Mr. Allen may be sure that he will have among his audience many thousands of those who read every month his contribution to The Railway Magazine under the heading "British Locomotive Practice and Performance."

* * *

There was a record attendance at the London Underground Railways Efficiency Meeting, held at the Training School, Chelsea, on March 20. Diplomas were awarded for courtesy, tidiness and general good conduct for the six months ending December, 1923. The following were the winning stations :—

District Railway ..	Mile End Station.
Bakerloo Line ..	Paddington.
	Warwick Avenue.
	Maida Vale.
Piccadilly Line ..	Holloway Road.
	Caledonian Road.
	York Road.
Hampstead Line ..	Strand.
	Charing Cross.
Central London Line	Liverpool Street.

Following this, a series of six papers were read by :—

Mr. J. Ryman, Travelling-Ticket Inspector, District Railway.
Mr. S. Coombs, Car Examiner, District Railway.
Mr. P. E. Morris, Switch Board Attendant, Lots Road Power House.
Mr. P. McElwee, Interpreter, L.G.O.C.
Mr. A. T. Wilford, Chemist, L.G.O.C.
Mr. T. H. Powell, Beat Inspector, L.G.O.C.

The subject in each case was "Problems of my Official Life."

* * *

Mr. H. Gosling, Minister of Transport, received, on April 3, at the House of Commons a deputation of the Industrial Group of M.P.'s, including Sir Arthur Shirley Benn, Sir Philip Dawson, Sir Frederick Hall and Mr. P. J. Hannon, on the question of improved transport facilities and the electrification of railways. The deputation urged the electrification of the North Eastern line between York and Newcastle, and sections of the railway in the districts of Glasgow, Liverpool and Manchester. Proposals were put forward that the Trade Facilities Act Committee should give more generous consideration to the question of railway electrification, and it was asked that they should be prepared for a period of 10 to 15 years to guarantee the interest on the capital necessary to carry out the schemes.

* * *

On April 10, the House of Commons decided by 245 votes to 112 in favour of a Supplementary Estimate of £70,000 to provide Members of Parliament with first-class railway travel between London and their constituencies.

* * *

Becontree, the large town the London County Council has built on the outskirts of Ilford, has been planned without railway facilities and the overcrowded service to Liverpool Street from Chadwell Heath and from Ilford has reached such a stage, that the public are demanding a new railway. A local committee has been exploring the possibilities of the Kearney high-speed railway system, by which it is claimed a tube could be built and run at a sufficiently remunerative ratio of profit to enable the capital cost to be repaid within twenty-five or thirty years, although the fares would be barely one-half the prevailing rates, and the speed would be double that of the existing services.

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THAT the shareholders who found the £5,000,000 for the electrification of various underground railways in London over 20 years ago had not till lately received a dividend was referred to recently by Sir Robert Perks. "It was hoped," he said, "that the lines would be worked at less than 50 per cent. of the gross receipts, but they were being worked at over 70 per cent. The employees had not suffered; indeed, their pay had largely increased. He contended that the companies carried the public at rates much lower than they could afford to do. It is true that in recent years the average return has risen to 2½d., or a trifle more, per head, but the increase in the working charges has swallowed up the increase. It is noteworthy that the increase in fares since 1913 has not had the effect of reducing the traffic either on the 'Underground' or other railways. Quite the reverse. The traffic has grown by leaps and bounds."

* * *

THERE has just been published by the London Underground Railways an illustrated guide on the "Pilgrim's Way in West Surrey," which is contemporary with the one published last year on "East Surrey." Copies may be obtained free from Electric Railway House, St. James' Park Station; a 2d. stamp should be sent to cover cost of postage. To ramblers, this little work will add considerable interest in exploring the rolling country which stretches from Dorking to the Hog's Back by way of Newland's Corner and Guildford.

* * *

A "PETER PAN" poster map of Kensington Gardens, issued by the London Underground Electric Railways, is based on Sir James Barrie's famous book. The map has been executed by Mr. Macdonald Gill, and is in keeping with the other maps of London which have made fame. Copies of Mr. Gill's first comic poster map of the Underground system have recently changed hands for £10. The demand for the new Peter Pan map amongst collectors is likely to be enormous. The number of copies printed has been limited to 1,500.

LONDON UNDERGROUND ELECTRIC RAILWAYS' NEW POSTER.

The original, in colours, the work of Mr. Phillip Connard, A.R.A., has struck an entirely novel note in poster art.

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An Inverness reader remarks in regard to recent locomotive developments on the Highland Section, London Midland and Scottish Railway, as follows: "4-4-0 engine, *Ben Mheadhoin* (H.R. No. 63), has come out of the shops painted red and numbered 14418, still retaining her name, but in a different style of lettering. She has been fitted with a Robinson superheater and a funnel similar to those on the locomotives of the Midland Section. No. 65, *Ben d Chait*, is in the shops at present, undergoing the same treatment. All the 'Clans' have now been fitted with Westinghouse pumps and fittings. No. 121, *Loch Ericht*, has been fitted with a new boiler, boiler mountings, cab, smokebox and funnel, all of the 'Caledonian' pattern; she is also being painted red. As the engines come into the shops the lamp brackets are being changed to suit the Railway Clearing House system of head codes."

* * *

Our Bath correspondent writes: The Great Western Railway locomotive No. 4105, *Earl Cawdor*, was built originally as one of the standard "Badminton" class, with a boiler of 4 ft. 5 in. outside diam., and raised Belpaire fire-box. This locomotive, in its first form, was used in March, 1899, to haul the Royal train which conveyed Queen Victoria to Folkestone. To enable the locomotive to make this through run from the Great Western system without a stop, the tender tank was enlarged at the back. The large boiler was fitted as an experiment in 1903. At the same time the larger cab, with two side windows and extended roof, was fitted. As thus rebuilt the engine bore a strong resemblance to the "1238" 4-4-0 class on the North Eastern Railway. The diameter of the new boiler, which was flush-topped, was 5 ft. 5 in. In this intermediate stage *Earl Cawdor* was illustrated in the Railway Magazine for November, 1903, and was referred to by the late Mr. Charles Rous-Marten in his monthly article. The heating surface amounted to a total of 1,937 sq. ft. Many years ago this engine was rebuilt uniform with the "4100" or "Flower" class.

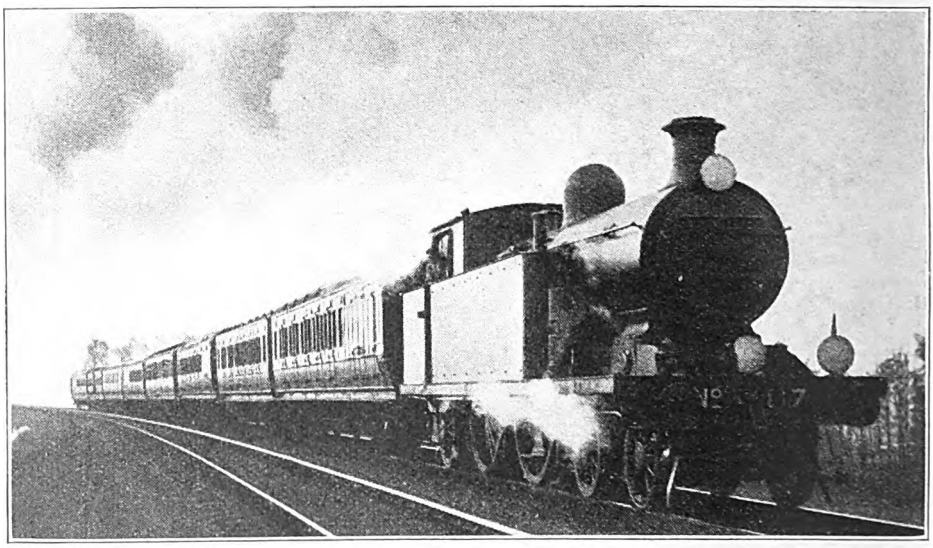

Photo.] [*O. J. Morris.*

NORTHBOUND "SUNNY SOUTH SPECIAL" NEAR MERSTHAM.
L.B. & S.C. 4-4-2 express tank engine No. 87.

* * *

From Crewe Mr. C. Williams reports: No. 2023, *Helvellyn*, is the latest 4-4-0 Precursor class locomotive to be converted to George the Fifth class (superheater), while No. 1912, *Colossus*, a 4-4-0 compound, has been converted to Renown class (two-cylinder simple). This latter now has an ordinary boiler in place of the previous one with Belpaire fire-box. A third engine of the Prince of Wales class (4-6-0) is now running with outside motion, viz., No. 56. The following passenger engines have been

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turned out in plain black finish (goods engine garb) and present quite the opposite effect to those which are in service painted red: 6 ft. 6 in. S.L. passenger No. 5039, *Corunna;* 6 ft. S.L. passenger Nos. 5080, *Waterloo,* and 5108, *Wyre,* and 5 ft. 6 in. 2-4-2 tank No. 6681. One of the 4-6-2 tanks, No. 6956 (old 217), has recently appeared in the new colours and with the coat-of-arms affixed to the bunker sides in place of the initials "L.M.S.," as in recent practice. It is the first engine on this section to be dealt with in this way.

* * *

AN order has been placed with Beyer, Peacock & Co. Ltd., Manchester, by the London and North Eastern Railway for one powerful "Garratt" articulated locomotive. It will be the largest engine in Great Britain and will have a tractive effort of some 62,000 lb. The engine will consist of two eight-coupled systems, and will weigh about 165 tons. The grate area will be approximately 56 sq. ft., and the four cylinders will be 21 in. dia. by 26 in. stroke. The wheel arrangement will be 2-8-0-0-8-2, and the coupled wheels 4 ft. 8 in. dia. This is the first articulated locomotive to be ordered by a British railway for use on standard gauge lines. At present there is but one "Garratt" locomotive at work in Great Britain, and that is engaged in and around some copper mills in South Wales.

* * *

A NUMBER of late London and North Western Railway locomotives of suitable classes have been fitted with modified cabs to permit of their working on sections of the Midland Division of the London Midland and Scottish Railway. A Bedford reader reports that "Prince of Wales" 4-6-0 class engines have been working certain trains from St. Pancras under this arrangement.

* * *

COMMENTING upon Mr. Gordon C. Hector's remarks concerning Southern Railway, Brighton Section, locomotives, published on p. 334 of the April number, Mr. Glirlson suggests that in the list of numbers of rebuilt "B 4" class engines, No. 67 should have been mentioned instead of No. 57. He continues: "There are 12 of these rebuilt engines in service, and it is to be hoped that more will be rebuilt, as they are doing excellent work. They have a very good turn of speed and can keep up a high average without deceleration on the long grades such as the one from Horley to Quarry Tunnel. When the 5.5. p.m. London Bridge to Eastbourne was accelerated last summer, it was at first worked by one of the large Baltic tanks, but the rebuilt B.4's now handle this train daily and nearly always keep time with ease. On March 27 one of these engines, No. 60 on the 7.30 a.m. *ex* Eastbourne, burst a tube at Horley and had to be run off. The train was taken on by No. 535B, an old 0-6-0 goods engine, painted and lined in the new goods colour." Mr. Glirlson mentions the following engines as having appeared in the new livery: 0-4-2 tank engines Nos. 266 and 280, and 4-4-2 tank engine No. 14, passenger green; 0-6-0 engines Nos. 453 and 535, 2-6-0 No. 349 and 0-6-2 tank engine No. 460 in black with green lines; 0-4-2 tank engine No. 287 and 0-4-2 tender engine No. 200 still retain the copper top to the chimney. In common with other observers, Mr. Glirlson expresses the hope that No. 333, *Remembrance,* will be allowed to retain the old "Brighton" colours, owing to the fact that it is the war memorial engine of the Brighton Section.

* * *

THREE additional 4-6-2 locomotives of Sir Vincent Raven's design have been completed at Darlington. They differ from Nos. 2400–1 in that outside radial bearings are employed for the trailing wheels. The three new engines are: No. 2402, *City of York;* No. 2403, *City of Durham;* No. 2404, *City of Ripon.* We understand that No. 2400 has been named *City of Newcastle.*

* * *

MR. E. J. DOREY mentions that a number of South Western Section locomotives are at work numbered and lettered in the style adopted by the Southern Railway. Many, but not all, have the letter "E" placed over the number. He points out that the placing of numbers on the tender should cause an alteration in the policy of the South Western Section, where it used to be a very common thing for engine and tender to have different numbers; in fact, sometimes one could see five or six in succession with tenders belonging to other engines of the same class. The shed code formerly carried on the framing of the Brighton Section engines was done away with some time before the amalgamation. It is a very rare thing on this section for an engine to have a tender belonging to another engine.

* * *

H. C. R. REPORTS having observed a set of old London and South Western six-wheeled vehicles on the South Eastern and Chatham Section of the Southern Railway painted brown, although lettered "Southern Railway."

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MR. R. W. BLUNT refers to renumbered L.M.S. (L.N.W.) locomotives recently noted at Oxford, including 4-4-0's Nos. 5365, *Racehorse*, and 5392, *Queen Mary*, painted red, and 2-4-0 No. 5108, *Wyre*, painted black. He remarks the occasional appearance of Midland 2-4-0 engine No. 280 at Oxford. On the Great Western line, he says, 4-4-0 engines Nos. 3282, 3300 and 3368, previously named *Chepstow Castle*, *Pendennis Castle* and *Sir Ernest Palmer*, respectively, are running without nameplates and he has observed "Castle" class engine No. 4081, *Warwick Castle*, on trial trips between Swindon and Oxford.

* * *

FROM Benares, India, the Rev. W. Machin writes: At 7 p.m., March 14, a Rohilkhund and Kumaon Railway (metre gauge) mixed train was passing over the Ram Ganga bridge, a long, high viaduct, 3 miles from Bareilly Junction, when it was struck by the full force of a very severe cyclone. Five third-class bogie coaches in the rear of the train, including a third-class composite brake van, were blown over, two falling into the water, and three on the dry bed. Four fell roof downwards, and were completely smashed, the passengers being imprisoned in the debris. The casualties are estimated at 53 injured and 40 to 50 killed. The guard was seriously injured. The bridge has both standard (5 ft. 6 in.) and metre gauge tracks, and is common to the Rohilkhund and Kumaon Railway and the Oudh and Rohilkhand Railway. The bridge was not damaged.

* * *

REFERRING to illustrations appearing on p. 277, April RAILWAY MAGAZINE, showing views of the new "Union Limited" express on the South African Railways, Mr. W. Jarvis Palmer states that the train is composed usually of six first-class sleeping saloons for Johannesburg, one for Pretoria and one for Durban, which is detached at Kimberley, a dining saloon and a baggage van. The engines used on the lower sections are of class 15A, 4-8-2's with 4 ft. 9 in. coupled wheels and cylinders 22 in. by 28 in. These develop a tractive force of 32,990 lb. at 75 per cent. boiler pressure. On the Transvaal sections 16th-class engines are used; these are 4-6-2's with 5-ft. coupled wheels and cylinders 22 in. by 26 in. At 75 per cent. boiler pressure their tractive effort is 29,887 lb.

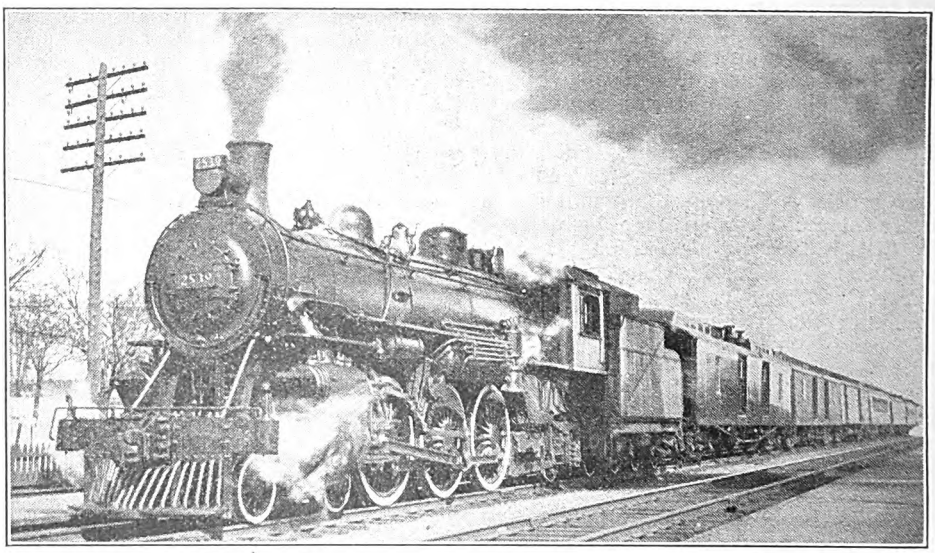

Photo.] CANADIAN PACIFIC RAILWAY. [*C. H. Tester.*

Montreal–Halifax midday express leaving Montreal West Station.
4-6-2 engine No. 2539.

* * *

BY the courtesy of Messrs. Perry & Co. Ltd., contractors, and the London Electric Railways, a party of members of the newly-formed Wimbledon and District Model Railway Club paid a visit to the reconstruction works in connection with the City and South London Railway on April 5. The party was arranged in two separately conducted groups, each being taken on a

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tour of inspection along the enlarged tunnels between Moorgate Street and the Angel.

* * *

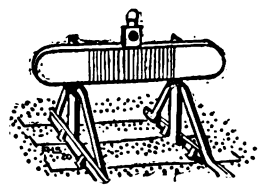
As we go to press it is announced that H.R.H. Prince George will perform the opening ceremony at Harwich, April 24, when the train-ferry service between that port and Zeebrugge will be inaugurated. Its special feature is the conveyance of goods in the same wagon from point of loading to final destination, thus securing not only more rapid transport (an important point in the case of perishable traffic), but the elimination of truck-to-ship and ship-to-truck handling at the ports. In this way packing charges are reduced, damage and risk of pilferage lessened, with a consequent reduction of insurance costs. The London & North Eastern Railway, in co-operating with the Great Eastern Train Ferries Ltd. (who own the ferry steamers and terminal at Harwich) to establish this all-rail route to and from the Continent, have undertaken to manage the service. The Belgian State Railways have placed at the disposal of the ferry a large number of special wagons suitable for through running over both British and Continental railways. The three ferry steamers which have been acquired have proved well adapted to maintain a regular and punctual service. One of them recently accomplished a successful trial trip, when 18 railway coaches were embarked at Zeebrugge. Leaving the Belgian terminal in the afternoon, the vessel arrived at Harwich in the evening, and was berthed the following morning, the operations involved, including the disembarkation of the coaches, being carried out without a hitch.

* * *

ANNOUNCEMENT is made by the London and North Eastern Railway that the line between Cuffley and Stevenage, a little over 14½ miles, which has been used for goods traffic since February, 1921, will be opened for passenger traffic on Monday, June 2. The line is a portion of the loop connecting Wood Green with Stevenage, and forms an alternative route to the main line, which passes through Potters Par and Welwyn. The first section of the loop, between Enfield and Cuffley, has been used for both classes of traffic since 1909. The new section runs from Cuffley by way of Bayford, Hertford, Stapleford and Watton, thence to Stevenage, where it joins the main line south of the station. The completion of this line provides a new route between Hertford and King's Cross, and the main service will be given by extending to and from Hertford some of the trains which now terminate at Cuffley and Gordon Hill, on both weekdays and Sundays. There will be a service between Hertford and Hitchin *via* Stevenage, worked by a rail-motor, and four trips will be run each way on weekdays. There will be no service over this line between Hertford and Hitchin on Sundays. In addition to the new station at Hertford, there will be a station at Bayford, and halts at Stapleford and Watton. A service of trains will be continued between Hertford and Hatfield, but the present Hertford North passenger station will be closed and all passenger traffic will be worked from and to the new Hertford North station from June 2. The opening of this new line will meet a long-felt want and prove of assistance in developing the district as a residential suburb of London. At the present time houses are being erected within a few minutes' walk of the new Hertford station.

* * *

IN order to enable through trains to be run between Northampton and Leicester, a connection has been put in between the old L.N.W. and Midland lines, near Market Harborough station. It is expected that this route will be ready for traffic in July, when a series of trains will, it is understood, be introduced connecting the towns mentioned. To effect a junction, the L.N.W. track had to be lowered to permit of the necessary crossovers being made between the respective lines which here run side by side. This connection will permit of important improvements in train services and obviate the need for changes at present required to make through journeys. It will also be of value in connection with various other improvements in contemplation.



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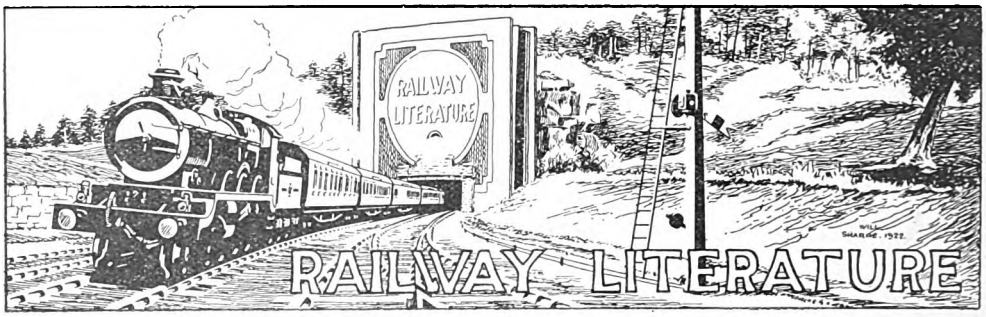

RAILWAYS OF THE WORLD. By Fred A. Talbot. [London: Cassell & Co., Ltd., Part 1. Price 1s. 2d.]

This is the first part of a work expected to be completed in about 20 fortnightly issues. Apparently it is being produced as a sequel to "Railway Wonders of the World," published ten years or so ago. The opening article recapitulates the oft-told story of the conception and development of the East Coast route between London and Scotland. This is followed by "Train Operation by Wireless," "The Family of Locomotives" and "Where the Snow-plough Works in Summer."

ROAD, RAIL AND WATER TRANSPORT MAP OF ENGLAND AND WALES. [George Philip & Son, Ltd., 32, Fleet Street, London, E.C.4.]

This map constitutes a valuable development of maps previously issued, in that it shows the railways of England and Wales, the respective groups being distinguished by colour markings, with variations in the group colour to cover the constituent companies, together with the main radial roads (double black lines) and other first-class roads (single black lines), the Ministry of Transport road numbers being shown, and the navigable rivers and canals. Distinctive lettering is employed to distinguish between canals under the Canal Control Committee, canals under the Railway Executive Committee, and uncontrolled canals. The size of the map admits of a large scale and consequent fulness of detail without overcrowding, and the inclusion of other details such as county boundaries, numerous town names, steamship routes with distances, &c., combined with the special features, goes to make one of the most useful reference maps ever issued. The map is 36 in. by 44 in., on a scale of 10 miles to 1 in., and is supplied in the following editions: in sheet form, unmounted, 9s. 6d. net (also supplied in black only at 5s. net); mounted on cloth and varnished, with rollers, 12s. 6d. net; mounted on cloth and folded in case, 15s. net.

PERMANENT-WAY INSTITUTION PROCEEDINGS.

Despite absence of conspicuousness, the permanent way is of high importance in railway operation, evidenced by the fact that between 20 and 25 per cent. of the whole operating expenses of railway are spent by the civil engineering department. Many years ago, members of the railway engineering service concerned with the permanent way, recognised their, and its, importance, and over 40 years ago formed the Permanent-way Institution, which increases both in engineering importance and in membership year by year. A very useful technical publication issued by the Permanent-way Institution is the *Journal and Report of the Proceedings*, published three times a year under the Hon. Editorship of Mr. E. Treacher, A.M.Inst.C.E., of the Southern Railway. The latest number of the *Journal* is full of useful and informative matter for permanent-way engineers and their subordinates. Among the contents, papers on automatic telephones, maintenance of railway tunnels, and fastening of rails to sleepers are of particular interest.

Messrs. W. & G. Foyle, Ltd., booksellers, of 121-125, Charing Cross Road, London, W.C.2, send a new catalogue of technical and scientific books, second-hand and new, which they are prepared to supply. A total of 21 catalogues is issued by the firm, specified under various headings, and readers are invited to write for catalogues, which will be sent post free. Publications of all kinds are dealt with, No. 7 comprising a comprehensive list of railway works of various kinds, including bound volumes and odd numbers of the RAILWAY MAGAZINE.

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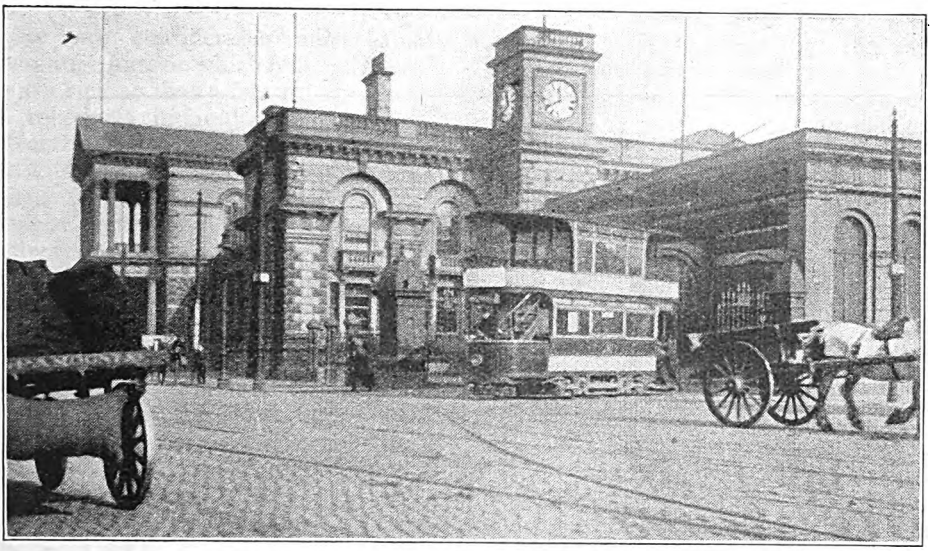

GENERAL VIEW OF YORK ROAD TERMINUS, BELFAST.
Showing Electric Tramcar leaving covered Yard inside Station.

Northern Counties Section (Ireland), L.M. & S.R.

By J. F. GAIRNS, M.I.Loco.E., M.Inst.T.

UNTIL disturbed conditions rendered either holiday or business travel in Ireland liable to untoward happenings, there was a very large tourist traffic between England, Wales and Scotland and Ireland, a considerable proportion of which, especially that for destinations in the northern counties, passed via what used to be the Belfast and Northern Counties Railway, though as from July 1, 1903, it became the Northern Counties Section of the Midland Railway, and is now associated with the London Midland and Scottish Railway. This system of lines is usually reached from Great Britain via Stranraer (railway steamers) and Larne, by L.M.S.R. steamers from Heysham and Fleetwood direct to Belfast, or by means of the Great Northern Railway and Dublin from Holyhead. Except in association with travel on other Irish lines, the principal routes are now those via Stranraer and Larne (the shortest sea passage) or from Fleetwood or Heysham to Belfast.

Now that peaceful conditions once again obtain in Ireland, and especially in the northern counties with which we are primarily concerned, it is well to remind our readers that the districts served by the Northern Counties Committee's system of lines possess great historic associations, while N.C.C. trains give access to many of the most interesting scenic areas, and numerous attractive holiday resorts, some of which include characteristics unknown elsewhere in the British Isles. There is also the attraction of travel in a country which, while under the British Crown, is yet in many respects "foreign," though English is the language generally in use. The railway also provides good facilities on a very wide basis, generous excursion arrangements are in force (frequently at fares considerably below the single-fare rates now standard in Great Britain), and numerous combined tours are available, including motor coach, steamer and tramway, as well as railway conveyance. There is a further interest, too, for British visitors,

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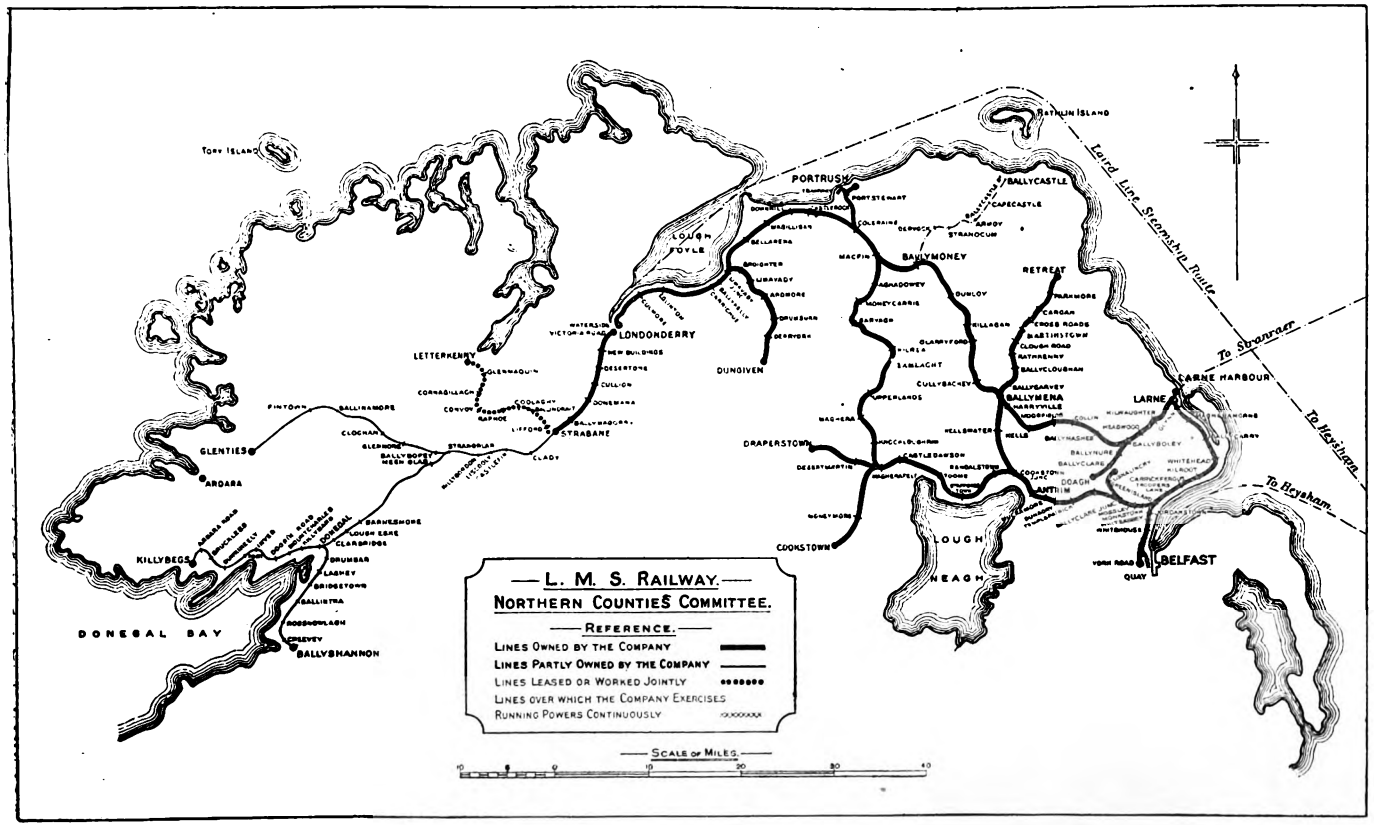

GENERAL MAP OF NORTHERN COUNTIES COMMITTEE'S RAILWAYS, L.M. & S.R.

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as there are considerable mileages of narrow-gauge lines on which real "express" trains are run, so that a feature of railway travel relatively unfamiliar is presented. The Northern Counties system is associated with through ordinary and tourist bookings and with comprehensive and convenient excursion facilities arranged by the railways in Great Britain.

Though the Northern Counties railway system is located entirely within the northern section of Ireland, it is by no means a small line, consisting of some 265 route miles, of which 64 miles are on the 3-ft. gauge, the remainder being 5-ft. 3-in. gauge.

The main lines centre upon Belfast, where the York Road station, the headquarters of the line and the principal terminus, is quite an imposing building and the scene of considerable traffic at its five platforms. Adjacent are the company's hotel and the railway workshops, goods depot, and other premises. Thence to Greenisland is the only route concerned, but at that station trains for the Londonderry direction have to reverse, though Larne trains have a direct run to their terminus at Larne Harbour. From Greenisland the main line passes through Antrim to Ballymena, putting off the Ballyclare branch at Kingsbog Junction, and the Cookstown branch at Cookstown Junction. At Ballymena the narrow-gauge line direct from Larne makes connection, continuing as the Parkmore and Cushendall branch, while the main line proceeds to Ballymoney (connection with Ballycastle Railway, now closed), Macfin (where the Derry Central line from Magherafelt, Cookstown, and Draperstown comes in), Coleraine (for the Portstewart and Portrush line), and Limavady Junction (for the Limavady and Dungiven branch) to Londonderry. At that town there is no running connection with the narrow-gauge branch to Strabane which connects with the County Donegal lines, but rail communication for exchange of goods traffic between broad and narrow gauge is available. The County Donegal lines extend from Strabane to Killybegs via Stranorlar, with branches to Glenties, Ballyshannon, and Letterkenny.

The Northern Counties system began with the Belfast and Ballymena Railway, incorporated July 21, 1845. The first sod was cut at Whitehouse by the then Viscount Massereene and Ferrard, on November 6, 1845. The line was opened to Ballymena and to Carrickfergus on April 11, 1848. Even at that date a reversal at Greenisland was necessary in the case of Ballymena trains, this route having been adopted in order to avoid the adjacent mountains. The Ballymena, Ballymoney, Coleraine and Portrush Railway was opened in November, 1855, and by means of the Londonderry and Coleraine Railway—opened in sections in December, 1852, and July, 1853—a through route became available between Belfast and Londonderry, except that the Coleraine Viaduct was not ready until November, 1860, so that through rail communication was not completed until then.

By Act of May 15, 1860, the Belfast and Ballymena Railway became the Belfast and Northern Counties Railway, the Ballymena, Ballymoney, Coleraine and Portrush being amalgamated therewith in the following January, though it was not until July, 1871, that the Londonderry and Coleraine was also included. In October, 1862, the Carrickfergus and Larne Railway was opened, thus completing a through route between Belfast and Larne, though it was not until July, 1890, that this became part of the Northern Counties system.

In April, 1875, and in 1876 the Ballymena, Cushendall and Red Bay Railway (narrow gauge) was opened, and in August, 1877, and June and August, 1878, the Ballymena and Larne Railway (also narrow gauge) was brought into use. These were amalgamated with the Belfast and Northern Counties Railway in October, 1884, and July, 1889, respectively.

Other railways taken over were :—

Draperstown, opened July, 1883, amalgamated July, 1895.

Derry Central (Magherafelt to Macfin), opened February, 1880, amalgamated September, 1901.

Limavady and Dungiven, opened July, 1883, amalgamated February 1, 1907.

Portstewart Tramway, opened June, 1882, amalgamated June, 1897.

The Londonderry and Strabane section of the Donegal Railway was taken over in May, 1906, the remainder of the Donegal lines being jointly owned by the Midland

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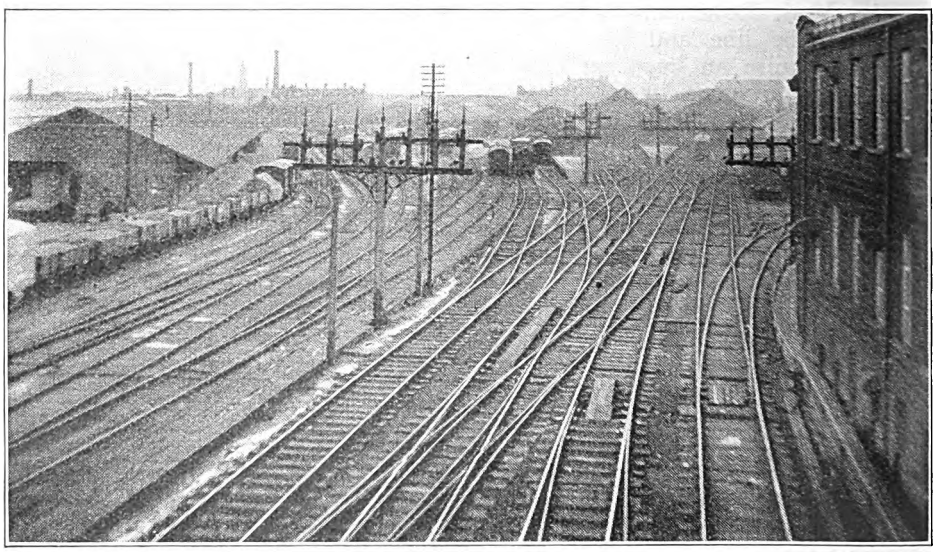
Railway (now L.M.S.) and the Great Northern Railway of Ireland, and worked as a separate system under the County Donegal Railways Joint Committee.

As from July 1, 1903, the Belfast and Northern Counties Railway was taken over by the English Midland Railway Company, and its affairs have since been administered by "The Northern Counties Committee," some of its members representing the English board and others Irish interests. For working purposes the Committee has its own officers and staff, and the line is operated as a distinct concern, though commercial aspects, and to some extent other matters also, involve association with the Board of Directors and the respective chief officers of the London Midland and Scottish Railway Company, as successors to the Midland Railway Company.



APPROACHES TO YORK ROAD STATION, BELFAST, AND GOODS YARD.

As the principal and in many respects the favourite route from Great Britain to Northern Ireland is via Stranraer and Larne, that means of communication may first be considered. This route dates back to 1862, but regular services were not established until 1872, since when it has been operated practically without intermission. For many years past up-to-date vessels have been employed, with good train facilities on both sides. The ships now on the service are the *Princess Maud*, built in 1904, and the *Princess Victoria*, built in 1912. Both are 300 ft. in length, and their gross tonnages, 1,655 and 1,687 respectively, designed for a speed of 20 knots (triple-screw turbine engines), and with passenger accommodations of 1,367 and 1,400. They have well-equipped dining and other saloons, with a number of private cabins, though only limited accommodation of this class is required owing to the shortness of the sea passage, which takes little more than two hours, of which only about 80 minutes are in open water; hence the special favour of this route with travellers who are not good sailors. During the summer months many passengers cross for the trip, so that even the extensive passenger accommodation of the vessels employed is often utilised to the full. A fair amount of cargo is also carried, while the night services convey the principal mails to and from Northern Ireland.

On the English side, a considerable traffic is conveyed all the year round by the express leaving Euston at 7.30 or 7.50 p.m., according to season, with through carriages and a sleeping car for Stranraer, and by the through service from Newcastle-on-Tyne, connecting with the London train at Carlisle. In the summer the L.M.S. Stranraer section becomes virtually a complete train throughout.

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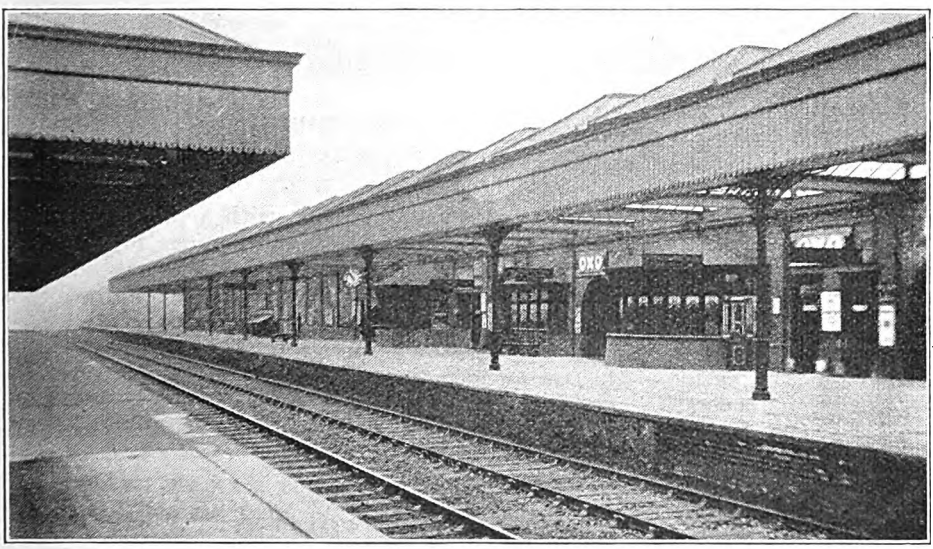
From Carlisle the train is usually taken on by late Glasgow and South Western locomotives, leaving the Glasgow main line at Dumfries. The completion of the run, from Castledouglas to Stranraer Harbour, is over the late Portpatrick and Wigtownshire Joint line. At the Harbour the train, together with the mail section which follows from Carlisle after the arrival of the postal train from Euston, is brought alongside the steamer, so that transfer is entirely convenient. As the journey from London is made during the night, a good night's rest can be taken on the train, as the transfer from train to steamer does not take place until after 6 a.m., the coast is felt, as the mouth of Larne Lough is approached. Mooring at Larne Harbour pier, passengers pass at once to the boat trains which are waiting in the adjacent Harbour station, that on the left being the broad-gauge express for Belfast, and that on the right the narrow-gauge express for Ballymena, by which good connections are available for Portrush, Londonderry, &c., without the delay entailed by travelling first to Belfast.

Adjacent to Larne Harbour station, itself quite a creditable one, with all necessary accommodation, are coal jetties and other premises of shipping and trading importance, a considerable amount of coal



DOWN MAIN LINE PLATFORM AT BALLYMENA.

crossing to Ireland being in daylight. The return steamer leaves Larne in the evening, the entire train journey to London being during convenient night hours. During the summer a day service from London is also given, with an evening crossing to Ireland. Nor is the Scotch traffic overlooked. A train leaves Stranraer Harbour at 9.25 p.m. for Glasgow in connection with the evening boat from Ireland, and in the summer there are connections to and from Glasgow with the daylight service.

Leaving Stranraer, the passage is for some distance in the quiet waters of Loch Ryan, while within less than two hours the sheltering effect of the Irish and general trade being dealt with, Larne being a centre for coastal shipping and various cargo services from England and Scotland.

The broad-gauge train is ordinarily composed of five bogie coaches, including both saloon and compartment stock, though during the tourist season and at the periods of heavy traffic this number has to be largely increased. It has accommodation for first, second, and third-class passengers, and is usually worked by one of the main line 4-4-0 superheater engines. The run to Belfast is of 24½ miles, for which 35 minutes are allowed—quite a good figure for a route largely single track, having six tablet sections, and including a

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TYPICAL MAIN LINE GOODS TRAIN.
0-6-0 locomotive No. 54.

number of sharp curves and fairly severe gradients.

Travelling first from Larne Harbour to Belfast, the adjacent Laharna Hotel (owned and manged by the Northern Counties Committee) may be noted, standing away from the industrial portion of the town in a position which renders it a convenient and desirable headquarters for tourists and others. Larne is a holiday resort as well as a traffic centre, and many Belfast business people reside there. Near the town station are the engine sheds and the narrow-gauge workshops.

For several miles the railway skirts the waters of Larne Lough, giving fine views of its waters and of Islandmagee. Near Magheramorne the scenery is generally very pretty. Here are extensive cement works, owned by the British Portland Cement Company. Ballycarry is a busy tourist centre, as it gives access to "The Gobbins," a wild rugged mass of cliffs and caves which attract many visitors and for whose convenience the railway has constructed and maintains bridges and protected footways.

The railway leaves the shelter of Islandmagee to pass alongside the broad waters of Belfast Lough, across which views can be had to Bangor on the County Down coast. Whitehead is quite a busy station, as the place is a favourite residential and holiday resort, with a promenade, bandstand and other attractions, to meet the cost of which the railway is a liberal contributor. The station has refreshment and tea rooms, and there are two auxiliary platforms at which special trains required during the summer months and on public holidays are accommodated. There is also a small shed where engines working the local trains are stationed.

Carrickfergus is a busy station and the terminus of local trains from and to Belfast. At Greenisland (originally named Carrickfergus Junction) connection is made with the Londonderry main line. As the Larne branch has a fairly heavy local and residential service all day long, while all main line trains have to reverse there, Greenisland is quite a busy station. In fact, it is claimed to be one of the busiest in Ireland.

The remaining 7 miles to Belfast include stations at Jordanstown, Whiteabbey and Whitehouse. Adjacent to Jordanstown is the recreation ground recently provided by the directors and officers for the benefit of the railway staff. A feature of the up platform at this end is the provision of numbered cubicles for the storage of bicycles, let at a small annual charge to people who cycle to and from this station daily. Whiteabbey is a neat and substantial suburban station. White-

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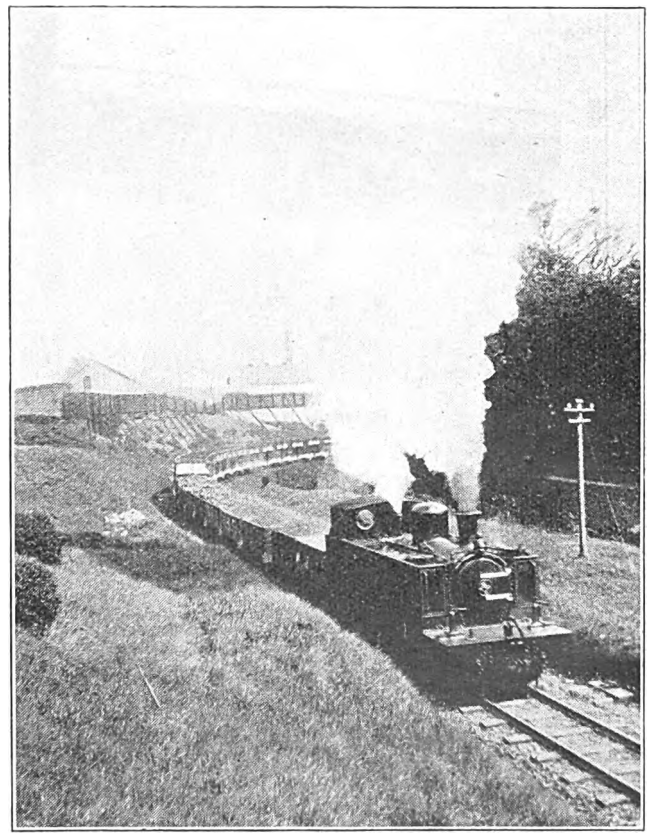
house is the last station before Belfast is reached.

Approaching Belfast, once more in sight of the waters of Belfast Lough, which had been lost to view for some miles, scenic beauty gives place to carriage sidings, goods yards and other signs of industrial activity. Nearer the terminus a large carriage washing shed, the locomotive and carriage works, a line round to the Belfast quays for conveying goods directly alongside ships, mineral traffic lines, &c., may be noted.

York Road terminus is a fine erection fronting one of Belfast's main thoroughfares, the imposing buildings including the headquarters offices, with refreshment and dining rooms, &c., and the Midland Station Hotel, owned and managed by the railway, which is highly esteemed by both business visitors and tourists. The Corporation electric tramways traverse York Street, and a service direct to the centre of the city is operated from a spur line terminating under the station portico. The station has five platforms, and as there is a considerable local traffic, particularly on the Larne branch, it is quite a busy place, especially on Saturday afternoons and at holiday periods, when large numbers of trippers travel out to Whitehead, Ballycarry and Larne, as well as to Portrush and other main line destinations.

As indicating the volume of regular traffic dealt with at York Road, it may be mentioned that the morning business trains arriving at 7.31, 7.40, 7.50, 8.20, 8.30, 8.35, 8.53, 9.0, 9.16 and 9.23 a.m. usually bring about 5,000 passengers into town, several regularly loading up to more than 500 per train. One of the busiest stations sending traffic to Belfast is Carrickfergus, which has over 500 season-ticket holders (apart from scholars' season-tickets issued during the school terms), and books some 150,000 passengers annually. Whitehead, Larne, Ballymena, Ballymoney, Coleraine and Londonderry are other principal booking stations, while Portrush has an exceptional holiday traffic.

Leaving Belfast again for the main line, the short run to Greenisland is quickly made. Here the main line locomotive is taken. From Greenisland to Coleraine is fairly ordinary country, mainly agricultural in character, but with spinning, weaving, paper and other mills and various works here and there, and giving signs in places of the peat moss industry which still provides a considerable amount of traffic. At Kingsbog Junction, beyond Ballyclare Junction, the Ballyclare branch diverges. Most of these trains work through from and to Belfast, constituting locals serving intermediate stations. A narrow gauge branch from Ballyboley also serves Ballyclare and Doagh, but the stations are quite distinct



NARROW GAUGE GOODS TRAIN.
Worsdell-von-Borries two-cylinder compound 2-4-2 tank engine No. 101.

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from those used by broad gauge trains. At Muckamore are large dyeing, bleaching and finishing works served by a private siding. Antrim is an important centre where connection is made with Great Northern trains, which use a side platform. Cookstown Junction is the junction for Randalstown, Magherafelt, Cookstown, &c. Kellswater is a centre for the peat moss industry.

Ballymena is quite a large town and the centre of many industries. The station, rebuilt some years ago, has two long main platforms, the narrow gauge trains being dealt with at the outer face of the up platform, which is an island. From the east the narrow gauge line comes in via Kells, and continues to the north to reach Parkmore. Ballymena station has refreshment rooms and other accommodation, while incline approaches to the subways facilitate the interchange of mail, parcels and other traffic between broad gauge and narrow gauge trains. This station is, in fact, one of the most modern and best equipped on the system, comparing only with the Belfast termimus and Portrush. Near by is an engine shed for both gauges, while a short distance beyond is an overhead stage by which ore and other mineral traffic received from the Parkmore branch can be transferred from narrow gauge hopper wagons to broad gauge.

North of Ballymena the line is single. At Ballymoney, 20 miles further on, the narrow-gauge Ballycastle Railway comes in alongside. The station is quite imposing in style, with a wide platform for Ballycastle trains, and that company's goods yard and sidings beyond. At Macfin the Derry Central line from Magherafelt comes in, though the branch trains work through to Coleraine to make connection. Coleraine is a busy centre, with bays outside each of the main platforms, and has refreshment rooms and other equipment.

GENERAL VIEW OF PORTRUSH STATION BUILDINGS.

Giant's Causeway vehicles in foreground to left.

Adjacent are extensive sidings, goods yard, engine shed, &c. This is the junction for Portrush, though many trains run through, and most of those for Londonderry have Portrush portions. Engines are usually changed, as the run from Belfast to Londonderry is too long to be covered both ways in a day's duty.

The old viaduct over the River Bann just beyond Coleraine station towards Londonderry, built in 1860, is 435 ft. in length, and consists of 16 fixed spans, together with two opening spans of 43 ft. It is not, however, adapted for modern loads, so that a deviation line and a new viaduct have been built to

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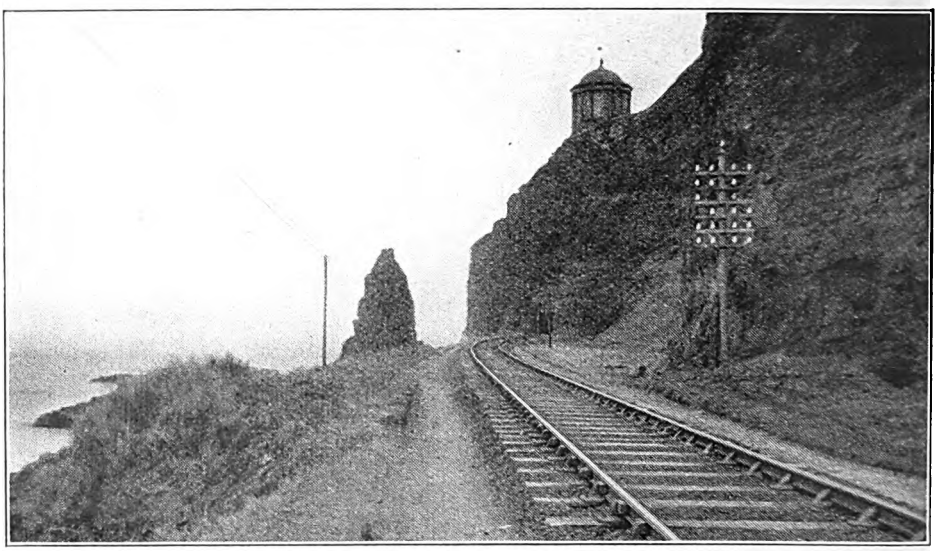
replace it, and were brought into use on March 21, 1924. The deviation line leaves the Portrush line some 120 yards on the Portrush side of the old Derry line junction. Shortly beyond the junction points the new line, which is on embankment, crosses Millburn Road by a girder bridge of 80 ft. span. The embankment then continues to the commencement of the principal viaduct. On the other side of the river the line is continued on embankment and then in cutting to join the existing main line to Londonderry. When the new line was brought into use the old route was abandoned beyond the junction with the branch to Coleraine Harbour. The new structure consists of 11 spans, five fixed spans on the Coleraine side, the counterweight span, the bascule span, and four fixed spans on the Londonderry side. The distance centre to centre of the piers in general is 77 ft., but on the Londonderry side this is modified in order to accommodate a curve of 1,320 ft. radius. The bascule span is 85 ft. centre to centre of piers, there being a clear waterway of 70 ft. between the fenders built around the piers on each side. The bascule span is of the Strauss type, with underhung counterweight, and is believed to be the first example of this type of bridge in the British Isles. It is, moreover, operated by means of a special hydraulic system which eliminates friction clutches and provides for reverse operation in place of reversing gears. The pump end of the hydraulic system is direct-connected to a petrol engine installed in the machinery house and the motor end engages the usual train of reduction gears.

The old line is now no longer required, except to give access to the Coleraine Harbour branch, used for goods traffic only. The old viaduct is to be removed, while the section of line to the junction with the new route will be disused. Londonderry trains, therefore, now use the Portrush branch for a short distance until diverging to cross the new viaduct. The river has considerable breadth, though its navigable width is relatively narrow. Seawards good views are had from the bridge of the broadening waters of the river. The town of Coleraine is the scene of various industries, and there is a fair amount of shipping trade; hence the necessity for the opening span in the viaduct and the Coleraine Harbour branch.

Beyond Coleraine the railway passes close to the coast for a considerable



ENTRANCE TO DOWNHILL TUNNEL ON ATLANTIC COAST.

The Tower shown was built by a former Bishop of Derry.

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distance, Castlerock and Downhill being favourite holiday resorts. The former is used as a residential centre by many Londonderry business people. In places the railway passes along the coast, which is rocky in character, with two tunnel sections, but with splendid sand stretches below the rocks. Above the line are the rugged towering slopes of the Downhill and Umbra cliffs. Proceeding inland, Magilligan station is passed. Not far away is the famous Magilligan Strand, a wonderful stretch of hard sand extending for about 11 miles, on which motor races and trials are held.

After passing Bellarena station the shores of Lough Foyle are approached, and followed all the way thence until the Lough becomes the River Foyle and the historic city of Londonderry is reached. The whole of the remaining distance is, in fact, on the water side, and here and there low embankments or viaducts are required to cross encroaching water spaces. Limavady Junction serves the branch to Limavady and Dungiven. Some of the branch trains work through to and from Londonderry. Approaching Londonderry the varied activities of that important city make themselves evident, as the train proceeds along the river bank to the terminus. The Northern Counties station known as Waterside is near the famous Carlisle bridge, which connects the sections of the town on either side of the river. This bridge has two levels, though only the upper is open to the public. Below is a railway track to enable wagons to be exchanged between the Northern Counties' broad-gauge and narrow-gauge lines on the east side and the Great Northern broad-gauge and Londonderry and Lough Swilly narrow-gauge lines on the west side, as well as for traffic to and from the quays. The connecting line is laid with both gauges, with turntables of special design, and the wagons are worked across by electric capstans, which have replaced the horse traction of earlier days. Mixed-gauge lines are laid along the wharves between the Northern Counties Waterside station and the Victoria Road station of the narrow-gauge branch to Strabane, the latter being immediately adjacent to the bridge. On the west side the Great Northern station is close to the end of the bridge, while broad-gauge lines are laid alongside the steamer berths which fringe the river for some distance, and narrow-gauge lines right through to the Londonderry and Lough Swilly station, though that is some distance from the centre of the city. The Northern Counties station at Londonderry has two platforms, with a middle line and ordinary accommodation, though it is somewhat out of date in many respects and is due for rebuilding.

The Limavady branch is of ordinary character, with one halt—Broighter—between the Junction and Limavady. The latter town is a fairly busy place on a small scale and has a number of locals which do not proceed through to Dungiven. The branches from Cookstown Junction and from Macfin to Magherafelt, and thence to Draperstown and Cookstown, carry a considerable amount of traffic. Randalstown served a big military centre during the war, and there is important agricultural and other traffic, while some stations serve cloth works and other industrial establishments. To cross the River Bann near the junction at Macfin a bridge having a span of 165 ft. is required.

It is, however, the Portrush branch which calls for most attention. This resort has come into tremendous favour for many years past. The fastest trains during the summer months are the 9 a.m. daily excursion train, and the 12.15 p.m. restaurant car express on Saturdays, returning at 7.20 p.m. and 8 p.m. respectively. The down trains are allowed 95 minutes for the journey of 67¾ miles and the up trains 5 minutes longer, in both cases with a stop at Greenisland for the inevitable reversal. There are also several other good trains in the season, together with a special express on Sundays at 9 a.m. from Belfast, returning at 7.20 p.m. These trains are always heavy, and the 12.15 p.m., with its restaurant car, constitutes the most popular service on the line. Although allowed 95 minutes for the down journey, the run is frequently made in 91 or 92 minutes. This is a much better performance than it looks on paper, as it must be remembered that gradients are in many places and for considerable distances reasonably hard. The first 11 miles from sea level at Belfast to the watershed of the line of coast hills at Kingsbog Junction

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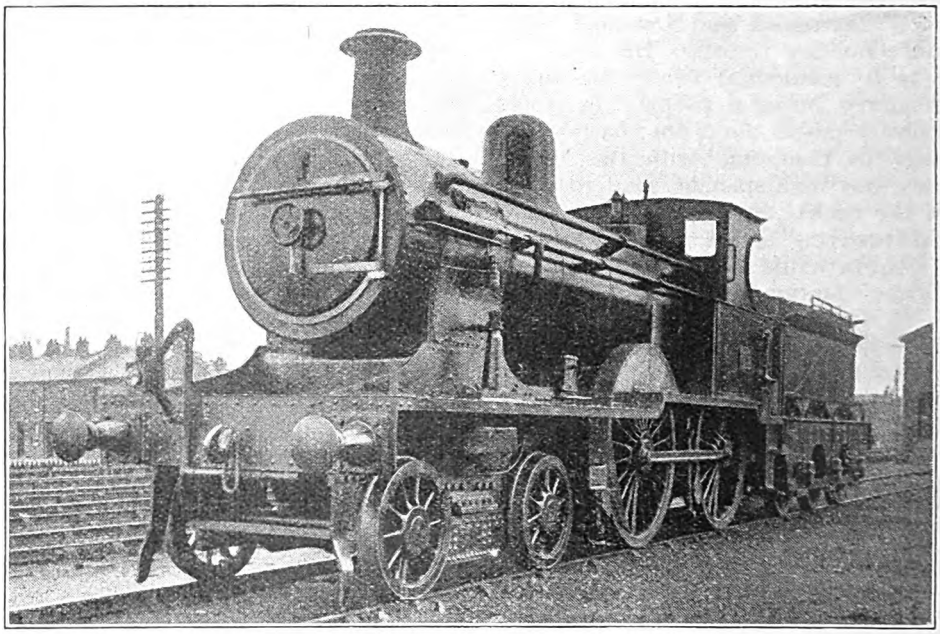

4-4-0 EXPRESS LOCOMOTIVE No. 70.

is continuous collarwork, part of which is as steep as 1 in 89. Moreover, more than half the distance is single track, though the tablets at the nine passing places are exchanged at speed.

Generous excursion facilities are offered, the day excursion fare from Belfast being 6s. 6d. first class and 4s. third class. In 1923, the traffic exceeded that of any previous year. In addition to the ordinary and excursion services, frequent special trains are run, in some cases conveying guaranteed parties of as many as 2,000 passengers.

Leaving Coleraine, and parting company with the new deviation line, Portstewart is the first station on the branch. Here the railway operates a steam tramway starting from the station to connect with the town of Portstewart, a favourite holiday resort on the coast, about 1¾ miles distant. It is a somewhat antiquated concern, but serves a useful purpose. The engines are closed in, with high chimneys, and one or more vehicles of single- or double-decker type are hauled. The journey is quite interesting, while Portstewart has two excellent golf courses of 12 and 18 holes respectively, a promenade and other attributes of a holiday resort.

Leaving Portstewart station the Portrush line continues to its terminus, giving interesting views seawards as it approaches its destination. The station is an imposing erection, with buildings somewhat in Swiss chalet style, and designed, as it need be, for dealing with large numbers of passengers at its three platforms. There are refreshment rooms and other accommodation, while alongside, with a balcony overlooking the sea, is a concert hall, owned and maintained by the railway, where concert parties perform during the season and various functions are held. The present structure was built in 1893, in "half-timber" style. The frontage is 140 ft. wide, facing the Town Hall. A four-faced clock is mounted in the tower. Platforms are 600 ft. in length.

A short distance away is the Northern Counties Hotel, a large establishment in great favour, equipped in high-class style and designed to attract visitors of the best class. It has a fine dining-room, a ballroom and other attractions, including a range of salt and fresh water baths, a large garage, &c. It is not surprising, in view of the good facilities and the associated actitivies provided by the railway, that the Portrush traffic has become so great a factor. In itself, Portush is an ideal resort, the railway has assisted very

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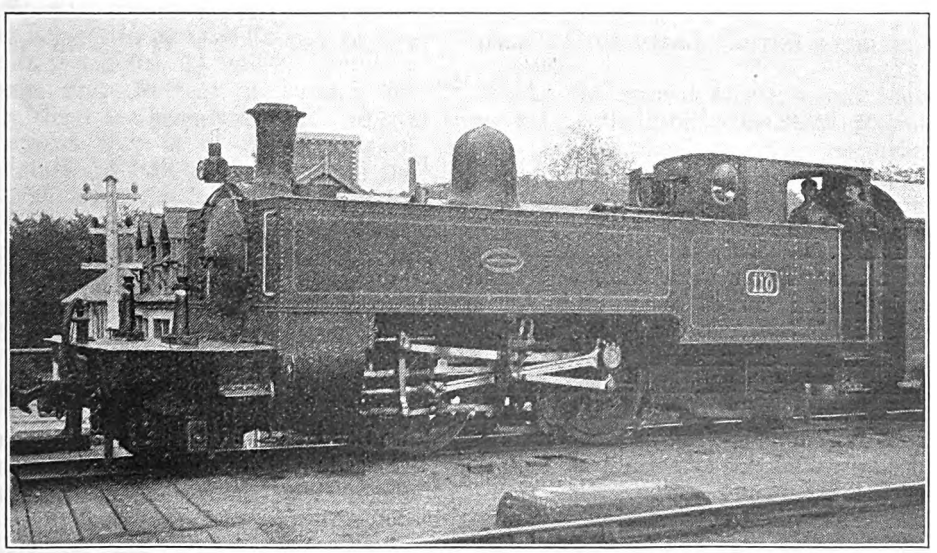
materially in providing both accommodation and amusement for visitors, golf on the famous links near by is a very important attraction, while the natural beauties of the coast and the convenient access to the Giant's Causeway fully justify the emphasis which has to be laid on this traffic.

The famous electric railway for the Giant's Causeway starts outside the station. This line, which rejoices in the title of the Giant's Causeway, Portrush and Bush Valley Railway, is on the 3-ft. gauge, and includes what was the first electric railway or tramway in the British Isles. It was incorporated in 1880, and opened to Bushmills, still the generating station, in 1883. · It was at first a third-rail line, a fact which caused much trouble on sections laid along the public roads. Steam tramway engines worked the trains through the streets of Portrush itself. For many years, however, the overhead system has been used, and trains work through on this system for the entire 8 miles between Portrush station and the terminus near the Giant's Causeway. The train consists usually of an uncovered motor-car and a covered trailer car, with additional vehicles as required. A certain amount of goods traffic is also conveyed in suitable wagons.

Leaving Portrush, the tramway skirts the headlands for some distance, giving magnificent views of the coast, in places passing right on the edge of precipitous cliffs. *En route* may be observed the Skerries, the White Rocks, the Giant's Head, the Wishing Arch and the ruins of Dunluce Castle. The concluding stage is more inland, and on private right-of-way, though the terminus is convenient for several large hotels and is only a short walk from the famous Causeway itself. A small charge is made for admission to the enclosed section, where accommodation for visitors is provided. The rock formations and the various attractions of this unique area naturally constitute a never-failing attraction to visitors.

Dealing now with the narrow-gauge line of the Northern Counties system, a commencement may be made at Larne. Here are the narrow-gauge locomotive and carriage works, though for heavy repairs engines and vehicles may be transferred to Belfast on special transfer vehicles. At Larne the narrow-gauge trains leave the broad-gauge line and run to an adjacent one-platform station. Thence to Ballyboley are two intermediate halts, Kilwaughter and Headwood. Ballyboley is quite a busy centre, with two platforms for Ballymena trains (these usually cross here) and one for the Doagh branch. There are also extensive sidings, and as many as four engines may be on view at the same time.



2-4-2 NARROW-GAUGE TANK ENGINE No. 110 (AS ORIGINALLY BUILT).

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BROAD GAUGE LOCOMOTIVES.

TENDER ENGINES.

Class.	Number.	Type.	Cylinders.	Coupled Wheel (Diameter).	Total Weight.
			in.	ft. in.	tons. cwt. qrs.
A	3, 4, 5, 9, 17, 20, 34, 63, 64, 65, 66, 67, 68	4-4-0	18 and 26 × 24	6 0	73 18 1
B	24, 59, 62	4-4-0	16 and 23½ × 24	6 0	68 14 1
B1	60, 61	4-4-0	16 and 23½ × 24	6 0	72 6 1
C	21, 33, 51, 52, 56, 57, 58 ..	2-4-0	16 and 23½ × 24	6 0	61 13 0
D	50, 55	4-4-0	18 and 26 × 24	7 0	75 6 1
E	53, 54	0-6-0	18 and 26 × 24	5 2½	67 18 0
F	23, 45, 46	2-4-0	17 × 24 ..	6 0	59 17 0
G	8, 11, 22, 29, 40, 41	2-4-0	16 × 22 ..	5 7½	58 7 0
G1	6, 10, 27	2-4-0	16 × 22 ..	5 7½	62 8 0
H	12, 13A, 14A, 15A	2-4-0	15 × 22 ..	5 7½	52 8 0
I	1, 2	2-4-0	15 × 20 ..	5 7½	50 13 0
K	28, 30, 31, 38	0-6-0	17 × 24 ..	5 2⅝	62 16 0
K1	7, 32, 39, 43, 44	0-6-0	17 × 24 ..	5 2⅝	63 15 0
L	18, 19, 35	0-6-0	17 × 24 ..	4 7½	63 3 0
L1	36, 37	0-6-0	17 × 24 ..	5 2⅝	63 2 0
M	26	0-4-2	17 × 24 ..	5 2⅝	63 15 0
U	70, 71, 72, 73	4-4-0	19 × 24 ..	6 0	76 9 1
V	13, 14, 15	0-6-0	19 × 24 ..	5 2½	76 12 1
		TANK ENGINES.			
J	25, 47, 48, 49	2-4-0	15 × 20 ..	5 2⅝	37 8 0
N	16, 42	0-4-0	16 × 22 ..	4 0⅛	31 1 0

Leaving the station, the Ballymena train climbs a steep gradient, while the Doagh branch curves away on a lower level towards Ballyclare and Doagh. The next station, Ballynashee, "the place of the fairies," is the summit between Larne and Ballymena, the line having climbed 632 ft. in 12 miles. Intermediate stations to Kells call for no remark, but Kells is a fairly busy place. Approaching Ballymena, Harryville goods station is convenient for all parts of the town and is the centre for goods traffic on the narrow-gauge line. At Ballymena trains come in alongside the broad-gauge line to the platform already mentioned. Larne trains do not usually work beyond, the Parkmore branch being operated separately.

This branch conveys a fair amount of passenger traffic and during the season is quite busy, as it gives access to a favourite part of the Antrim coast and to the famous Falls of Glenariff, as well as being associated with some of the popular round tours available for tourists. The branch also conveys a considerable amount of iron ore

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NARROW GAUGE LOCOMOTIVES.

TANK ENGINES.

Class.	Number.	Type.	Cylinders.	Coupled Wheel (Diameter).	Total Weight.
			in.	ft. in.	tons. cwt. qrs.
P	105	2-4-0	12½ × 18 ..	3 9	17 12 0
Q	106, 107, 108	0-6-0	13½ × 18 ..	3 3	22 9 2
R	109	2-6-0	14 × 18 ..	3 3	25 13 2
S	101, 102, 103, 104, 110, 111 ..	2-4-2	14¾ and 21 × 20	3 9	31 17 2
	PORTSTEWART TRAMWAY.				
	1, 2	0-4-0	7 × 12 ..	2 3¾	—
	3..	0-4-0	9½ × 12 ..	2 3¾	—

from districts served by it. For ordinary purposes the line ends at Parkmore, where new concrete buildings have been erected in place of those burnt down some time ago. Here road conveyances are available to visit Cushendall, Glenariff, and Red Bay. For mineral and goods traffic the line extends a further 2¾ miles to Retreat.

Gradients are frequently severe on all sections of the Northern Counties system, but 1 in 80 is not often exceeded on the broad-gauge sections, though some of the steeper sections are of considerable length. On the narrow-gauge lines, however, 1 in 40 or 50 is by no means infrequent, the steepest being 1 in 39 near Cargan, on the Parkmore line, for 1½ miles. Between Parkmore and Retreat a summit of 1,250 ft. above sea level is reached.

Permanent way is of 85-lb. rails of British standard bull-head section on the broad-gauge lines, flat-footed rails of 65 lb. being used on the narrow gauge. Signalling includes a large number of "somersault" signals of Great Northern pattern, a feature being that at some of the crossing stations on single-line sections trains can be signalled to either platform, or to either platform or non-platform crossing line, to enable any train to be dealt with at one platform, to overtake a goods waiting on one line, or, as at Limavady Junction, to facilitate transfer of traffic with a connecting branch train.

Double-line sections—Belfast to Greenisand and thence to Ballymena and Carrickfergus—are signalled with Tyer's absolute block instruments. Tyer's electric train tablet instruments are used between Ballymena and Londonderry, Carrickfergus and Larne Harbour, on the Cookstown and Derry Central line, on the Portrush branch, and the narrow-gauge section between Larne Harbour and Ballymena. Telegraph and telephone instruments, in connection with train staff and ticket, are used between Limavady and Dungiven, and on the Ballyclare and Parkmore branches. Electric staff instruments are used between Londonderry and Strabane. Track-circuiting is installed at York Road (Belfast), Greenisland, Carrickfergus, and Coleraine.

Among the special facilities and tours arranged by the Northern Counties Committee, besides the very cheap excursion arrangements to every place calling for them, week-end tickets, &c., are various combined tours. One of these is from Belfast to Larne and thence by road to Glenarm, Carnlough, and Garron Tower. The most attractive of all is, however, the circular tour of the Vale of Glenariff and the Antrim coast. From Belfast, rail is used to Ballymena and thence to Parkmore, and coach from Parkmore through the Vale of Glenariff and Cushendall and along the coast to Larne, whence the return is made by train. This tour can be made either way round, and there are bookings from various stations. The charge for the round trip is 14s. first, 12s. second, and

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MR. J. PEPPER,

Manager and Secretary.

10s. third class. The tour can be made in one day, but the tickets are available for completion within seven days. A circular tour, for which seven days are allowed, includes Portrush, the Giant's Causeway, road to Larne, and rail back to Belfast. Holders of tourist tickets from England can obtain eight-day contract tickets available over the greater portion of the N.C.C. system at very cheap rates. Besides the ordinary excursion arrangements there are week-end and Wednesday afternoon excursions to certain stations. Combined rail and hotel arrangements are in operation at the Portrush and Laharna hotels. At Portrush reduced terms for use of the golf links apply to residents at the railway's hotel. To encourage building in residential suburbs, "house free" seasons are issued under specified conditions.

In the early days of the railway a number of two-cylinder compound locomotives were placed in service. Twenty were 4-4-0 and seven 2-4-0 tender engines, while there were two 0-6-0 goods locomotives and six 2-4-2 narrow gauge tank engines. These have rendered good service and all are still at work, their appearance at the head of a train conveying a strange impression to the visitor owing to the fact that there are two exhausts only per revolution. They have, however, the usual weakness of two-cylinder compound locomotives, that of lack of elasticity for work other than that for which they are best suited, and increasing demands have been met entirely with non-compound superheater engines. One of the "B" class compounds is being rebuilt at present with superheater boiler and 18 × 24 cylinders. Five of the enlarged class "U" under construction by the North British Locomotive Co. Ltd., in Glasgow, are due for delivery for the summer's traffic. The present locomotive stock is made up as shown in the tables on pages 434 and 435.

On the broad gauge, passenger rolling-stock includes four restaurant cars, 118 vehicles of uniform class, 66 composite carriages, and two Post Office vans and 140 other coaching vehicles. For freight traffic there are 959 open wagons for loads of between 8 and 12 tons, 97 of 12-20 ton classes, and 6 for loads in excess of 20 tons. Covered wagons include 172 of under 8 tons capacity and 588 of the 8-12 ton class. Special wagons number 3; rail and timber trucks, 49; and brake vans, 38: There are 124 service vehicles. Rolling-stock for the narrow gauge lines includes 38 passenger train vehicles, 581 freight

MR. W. K. WALLACE,

Engineer and Locomotive Superintendent.

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vehicles and 8 service vehicles. The Portstewart Tramway has 3 passenger vehicles and 1 van. Rolling-stock for the line from Londonderry to Strabane is supplied by the County Donegal Railways. The Northern Counties Committee has its own road transport equipment.

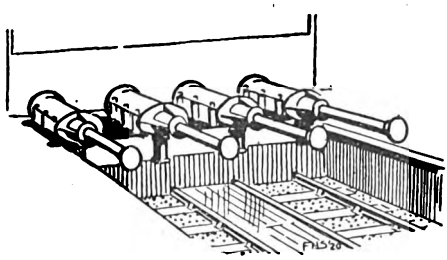
During 1923, 54,426 first-class, 88,295 second-class and 2,890,936 third-class passengers were conveyed, while equivalent annual season tickets numbered 201 first-class, 394 second-class and 2,381 third-class; 374,276 tons of general merchandise were conveyed, 182,841 tons of coal, coke and patent fuel, and 129,256 tons other minerals, together with 172,239 head of live-stock.

Mr. James Pepper is Manager and Secretary to the Committee; Mr. W. K. Wallace, Engineer and Locomotive Superintendent.

Mr. Pepper commenced his railway career on the Furness Railway. Subsequently he joined the staff of the London & North Western Railway, and later transferred to the Lancashire, Derbyshire and East Coast Railway, and, in 1903, took a position outside the railway service. In 1908 he joined the Midland Railway, in the Chief Goods Manager's office at Derby, where he was chiefly engaged in connection with the reorganisation of goods terminal arrangements. In 1916 he was appointed London Outdoor Goods Manager, and 18 months later London District Goods Manager. In this position he found opportunity for the initiation and development of cartage control in London and district. In March, 1919, Mr. Pepper was promoted to the position of Assistant Goods Manager at headquarters, Derby, and from October 1, 1922, he has been Manager and Secretary of the Northern Counties (Ireland) Section of the London Midland & Scottish Railway.

Mr. Wallace commenced his railway career in 1900 on the Belfast and Northern Counties Railway, when he became a pupil of the late Mr. B. D. Wise, M.I.C.E., continuing with the Belfast and Northern Counties Railway after it became the Northern Counties Section of the Midland Railway. Under Mr. Malcolm, Mr. Wallace has had wide experience, particularly on the civil engineering side. He had charge of the construction of the bridge over the River Bann and the deviation of the Midland Railway (Northern Counties Section) main line authorised by the Midland Railways Act of 1914. Upon the retirement of Mr. Malcolm on September 30, 1922, Mr. Wallace succeeded him, and this appointment has been continued with the London Midland and Scottish Railway, of which the Midland Railway is a constituent company.

The writer is indebted to Mr. Pepper and Mr. Wallace, together with other officers, for facilities and information utilised in the preparation of this article.



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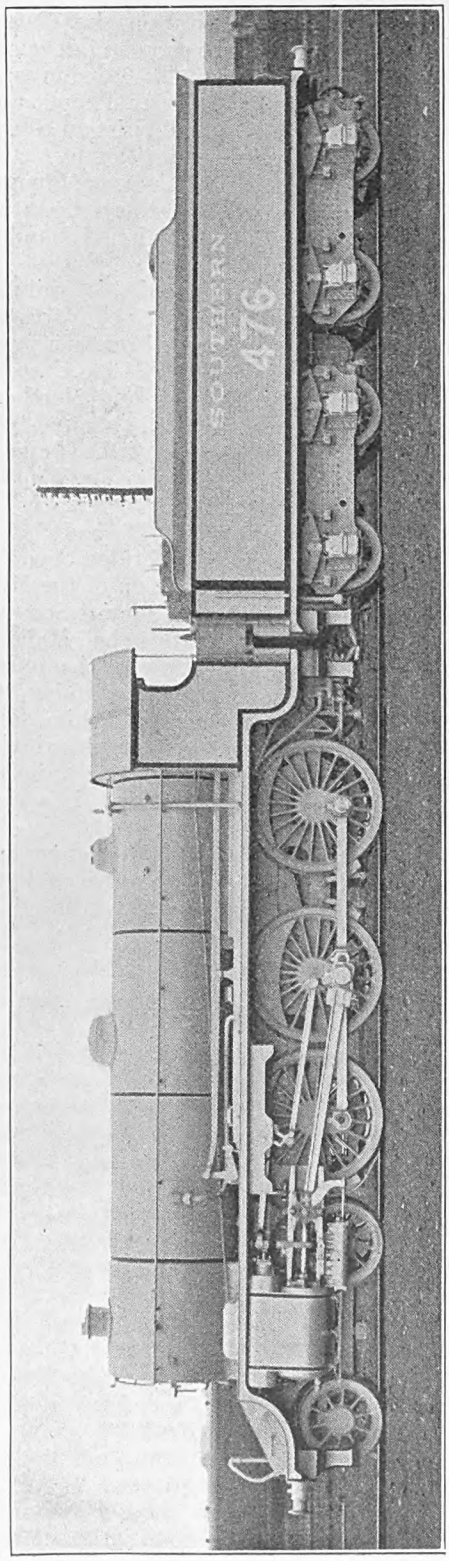

NEW 4-6-0 MIXED-TRAFFIC LOCOMOTIVE, SOUTHERN RAILWAY.

WE are indebted to Mr. R. E. L. Maunsell, Chief Mechanical Engineer, Southern Railway, for the photograph reproduced, showing one of the new 4-6-0 mixed-traffic locomotives recently placed in service and at present used mainly on the South Western Section. In general particulars the design corresponds with that of the express goods locomotives introduced by Mr. R. W. Urie. It has the same type of boiler, including a partially coned barrel, and is fitted with a similar tender. The framing, wheels, cylinders and motion are, however, identical with those of Mr. Urie's original 4-6-0 class, Nos. 482-491. Leading dimensions are, therefore, as follows :—

Cylinders	21 in. by 28 in.
Coupled wheels, diam. ..	6 ft. 0 in.
Bogie wheels, diam. ..	3 ft. 7 in.
Coupled wheelbase ..	13 ft. 9 in.
Engine wheelbase ..	26 ft. 7½ in.
Steam pressure	180 lb. per sq. in.
Heating surface—	
Firebox	162 sq. ft.
Tubes	1,716 sq. ft.
Superheater	308 sq. ft.
Total	2,186 sq. ft.
Grate area	30 sq. ft.
Adhesion weight	58 tons 17 cwts.
Engine weight in working order	79 tons 19 cwts.
Engine and tender ..	137 tons 10 cwts.
Water capacity of tender	5,000 galls.
Coal capacity of tender ..	5 tons.

It will be noticed that an air pump is arranged below the slidebars on the left-hand side, which is operated from the crosshead for maintaining the vacuum for the automatic brake.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

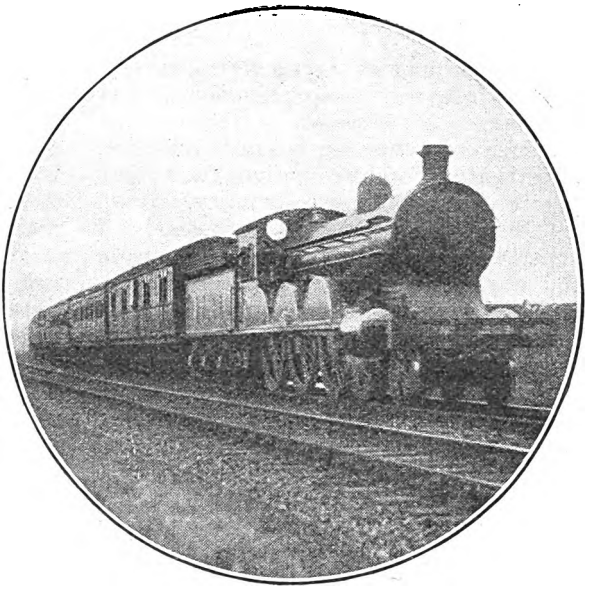

Photo.] [*C. J. L. Romanes.*

EDINBURGH (WAVERLEY) TO YORK EXPRESS.
N.E. 4–6–0 Engine No. 2115, Class S1.

SOME correspondence of more than usual value has reached me recently, by way of comment on the discussions which have been proceeding in these articles during the present year on the subject of locomotive efficiency, and more especially in regard to the question of compound locomotive propulsion. The first letter comes from a friend who, I well know, is very thoroughly informed as to the efficiency of the locomotive, on both the theoretical and the practical side. "Your statement," he begins, "that 'compound working is designed to carry the steam through a further stage of expansion' is, I think, a little misleading. Manifestly, a compound locomotive requires, for combustion purposes, as sharp a blast as a simple, and the back pressure must, therefore, be roughly the same in both cases. That is to say, the steam is expanded to just the same extent in both types. Further, why should it be possible to work a compound at a wider regulator opening and later cut-off than a simple? In point of fact, you will find that a Midland compound driver works a compound in much the same way as he would a Class 2 or Class 3 engine, and though the nominal cut-off in the high-pressure cylinder is later, the virtual cut-off, taking into account the *complete* expansion of the steam, will be much the same as in the simple under similar conditions of working. Compound expansion must be regarded as a single expansion, not extended, but divided into two parts (and incidentally with a receiver loss between them). And the thermal advantage of compound expansion is that, by reducing the changes of pressure, volume and temperature of the steam in each cylinder, the cylinder losses and especially the condensation losses are minimised."

My correspondent then quotes some figures from an important paper read by him recently on the subject of locomotive efficiency, in which he takes for his text the well-known experiments made a number of years ago at St. Louis, in the United States, in connection with this very question. In the simple engine the loss of thermal efficiency due to throttling of the steam at admission and exhaust was 10 per cent.; clearance loss was 5 per cent.; and condensation loss 25 per cent. In the compound engine throttling loss was 6 per cent., condensation loss 22 per cent., and receiver loss 6 per cent., while clearance loss was practically eliminated. Total losses in thermal efficiency in and around the cylinders were, therefore, 40 per cent. in the simple and 34 per cent. in the compound; but it should be added that certain

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of the compound systems under trial would hardly bear comparison, for efficient working, with the best-known present-day systems on the European Continent. Superheating on locomotives was then practically an unknown quantity.

"Now," my friend continues, "if superheating eliminates condensation in the single engine, as it practically does, the advantage of the alternative offered by compounding is reduced very considerably. Personally, I must differ with the opinion expressed by you some time ago; I think that superheating is a superior alternative to compounding. And in regard to superheating, could you put in a word to discredit that completely mistaken but widespread notion (due partly to some of the technical literature on the subject) that the increase of volume of superheated, as compared with saturated steam, has anything to do with the advantages of superheating? This increase of volume means that each pound of superheated steam requires a correspondingly greater amount of heat for its generation, and thermodynamically the advantage of superheating in this respect, unless the heat be carried to an almost impossible extreme, is negligible." "Finally," he adds, "you speak of a right relation between high and low pressure cylinder volumes. What is this relation? Such a relation, I think, that the work done in each should be roughly equal. Strictly speaking, this only applies when the regulator and the cut-off are at the positions assumed in the design. At other times the thrusts on the respective piston rods are unequal, and herein lies an essential disadvantage of a compound as compared, say, with a three-cylinder or four-cylinder simple."

The correction in regard to compounding carrying "the steam through a further stage of expansion" is welcome; I quite agree that to put the matter in this way is somewhat misleading, the fact being that the expansion is carried through in two stages, but not, in that sense, through a stage entirely additional to the stage of expansion in the simple engine of corresponding dimensions. At the same time, if we were to take two engines of generally similar dimensions, one simple and one compound—say, a Midland "999" and a compound "1000"—and were to admit to our cylinders an equal volume of steam per stroke, the greater aggregate volume of the three cylinders in the compound makes it certain that the final volume of the expanded steam

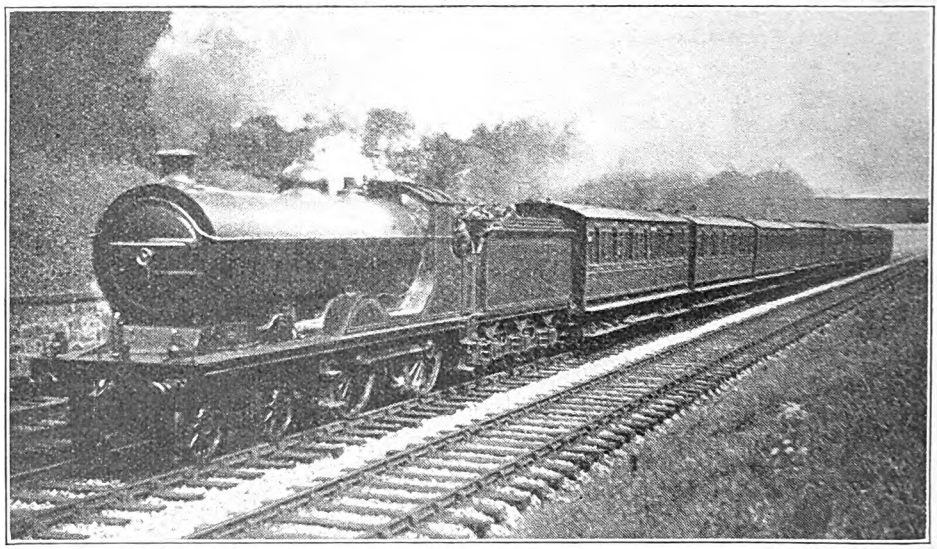

Photo.] [*Henry L. Salmon.*

GLASGOW-AYR AND GIRVAN EXPRESS NEAR IBROX.

Glasgow and South Western 4–4-0 Locomotive No. 329.

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in this case will be greater than in the case of the simple. Pressure towards the end of the stroke is, however, so low, as the result of expansion, that I can well believe that the difference in the expansion ratios will not greatly affect the relative working or efficiency of the engines concerned. But my point is that, allowing for the greater aggregate cylinder volume in the compound, in the case of comparable compound and simple locomotives, there must be at least some "extension" of, or increase in, the expansion ratio in the former case.

Then I would like to ask: Why *must* superheating always be regarded in this country as the *alternative* of compounding, from the efficiency point of view, rather than as its ally? The contrast between the two runs from St. Pancras to Nottingham, which I published in my April article, even if it be allowed that the non-superheated compound was possibly out of condition and certainly made a poor show, was too strikingly in favour of the superheated compound to escape notice. But, further than that, the historic Maréchal locomotive trials on the P.L.M. Railway of France will take a good deal of explaining away. I dealt with these tests in detail in my October, 1917, article, but as that was a number of years ago, a recapitulation of the chief figures may be useful. On the P.L.M. simple superheated "Pacific" engines with 4 cylinders had been tried against 4-cylinder compound engines of corresponding dimensions; but the final inclusion in the trials of superheated 4-cylinder compounds resulted in a definite reversion to compounding on that railway. The tests were conducted between Laroche and Dijon, on the continuous ascent of 1,020 ft. from Laroche to Blaisy Bas. For the first 63¼ miles, to Les Laumes, the ascent does not exceed 1 in 200 and averages 1 in 300 to 500, but the concluding 19½ miles of the climb are steeper, first at 1 in 200, and then for the last 8 miles chiefly at 1 in 140-125. The results of the trials will best be appreciated by the table below.

The crux of the whole matter was that the engines were in all cases, and especially with the heavier loads, being worked very hard. For over 80 miles on end trains weighing up to 635 tons were being worked at high speeds over a route rising on the average 12½ ft. per mile, and in clear difference of level over a thousand feet. The average consumption of fuel, which amounted to 70, 75, 79 and 85 lb. per mile on the compound trips, was certainly heavy, but the inferior quality of the slack usually burned in France is notorious, and even so, the consumption on the hardest trip, with 635 tons, only works out at 2·05 lb. per i.h.p. hour. But the essential point, I repeat, is that the engines were being worked under maximum conditions, and it is only in such conditions that the maximum efficiency of the compound can be displayed. These are the conditions which, as I have mentioned previously, are so difficult to reproduce in this country, owing to the traditional tenderness with which our British locomotive stock is always treated. If, for example, a number of the Midland expresses now running in duplicate between London and Leicester, Leeds and Carlisle, could be combined, and their operation entrusted to the superheated Midland compounds *without* pilots, I fancy the real capacity of those fine engines would get some chance of demonstration.

Weight of train	274 tons.		378 tons.		480 tons.		635 tons.
	Simple.	Comp.	Simple.	Comp.	Simple.	Comp.	Comp. only.
Average speed up first part of climb (m.p.h.)	65·4	69·0	62·5	65·6	59·5	62·5	56·5
Average speed up second part of climb (m.p.h.)	63·8	65·6	58·4	61·4	53·8	54·8	49·2
Coal consumption (kg.)	4,020	2,627	3,860	2,816	4,230	2,982	3,206
Water consumption (cub. m.)	22·4	16·3	24·6	18·7	26·3	19·7	22·2

At this stage I propose to break off the discussion, as to continue with another lengthy letter on the same subject would trench too severely on the space available for performance, and I am particularly

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anxious to have plenty of room over which to spread my Great Western records. In the first place, there are a number of runs over the West of England main line to be described. These are all, without exception, due to the timing activities of correspondents, as for one reason or other I have not found it possible to travel over this route for some time past; it is really on account of a desire to include some of my own journeys that I have waited so long before dealing with this important course, but, although there are some definite prospects during the coming summer of rectifying this personal lack of recent running experience, it would be unfair to keep readers waiting any longer for what is always very popular fare.

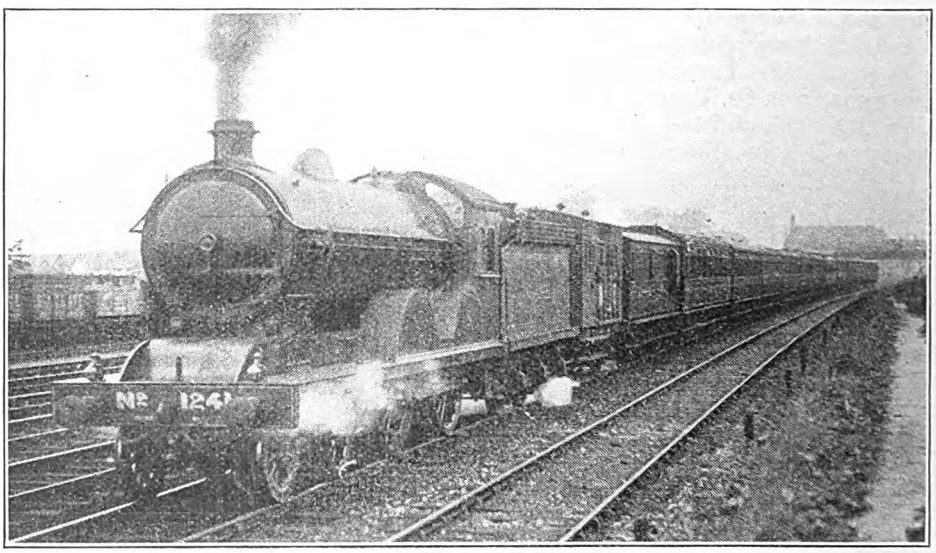

Photo.] [*Henry L. Salmon.*

YORK–NEWCASTLE RESTAURANT CAR EXPRESS NEAR YORK.

North Eastern 4-4-0 Locomotive No. 1241, Class R1.

The curious point about the runs now to be described is that nearly all the friends to whom I am indebted for their details seem to have found the far West so entrancing that they never returned; in my file there are eleven runs in the down direction via Westbury, as compared with a modest three returning to town! Out of these 14 the eight reproduced have been selected as showing the best all-round work, this being also the maximum number capable of compression into a table of reasonable compass. No. 1 was on the 12 noon Torquay express, No. 2 on the first portion of the "Riviera" express, when running in duplicate; No. 3 on the 11.10 a.m. to Newquay, and Nos. 4, 5 and 6 on the "Riviera" express, the timers in the first two cases being in the Exeter slip, and in the third in the through Cornish part of the train; of the two up runs the first was on the summer 1.25 p.m. express from Exeter, non-stop to Reading, and the second on the 5.10 p.m. from Westbury to Paddington, after the detaching at the former place of the Glasgow and Aberdeen section.

On the first run *Prince Albert* made a splendid start to Reading, with speeds of 61 m.p.h. at Southall, 74 at Slough, 69 at Taplow and 72½ at Maidenhead, and but for the signal check to 50 at Twyford would probably have passed Reading in less than "even time." Up the gradual rise from Theale to Thatcham, also, ranging chiefly from 1 in 450 to 715, with easier intermediate strips, the maintained speed of 60 to 67 m.p.h. was excellent, and "even time" had been improved on at Midgham, despite the Reading slack, when adverse signals brought the rate down to 40 m.p.h. at Newbury. But at Kintbury speed was again up to 60, and though the slightly steeper grades to

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Hungerford, culminating in a mile at 1 in 225-101-264, resulted in a drop to 57, on the easier length to Bedwyn 60 was again sustained, preliminary to a minimum of 50 on the 1 in 180 (2 m.) and 144 (½-m.) to Savernake Summit, where the train was 1½ min. early, despite both checks.

From there the engine was driven very easily, not exceeding 68 m.p.h. at Pewsey, but after a third and very lengthy check, to 40 m.p.h. at Woodborough, 76½ was touched down the 1 in 222 to Lavington, and Westbury was passed ¾ min. early. On the easy grades after Frome slack 52½ m.p.h. was attained, and the minimum at least 7 min. under the three hours. But the load was light throughout, to the standards which prevail on this service.

In the second run my correspondent gave no details of intermediate speeds, but it is clear that some noteworthy work was done over certain sections. There was a slight signal check at Hanwell, but in virtue of an unusually rapid start to Ealing, and good speed beyond Slough, Reading was passed ½ min. inside "even time." Aided by an absence of checks, and by dint of fine locomotive work, the driver averaged a shade over 60 m.p.h. from Southcote Junction up to Savernake,

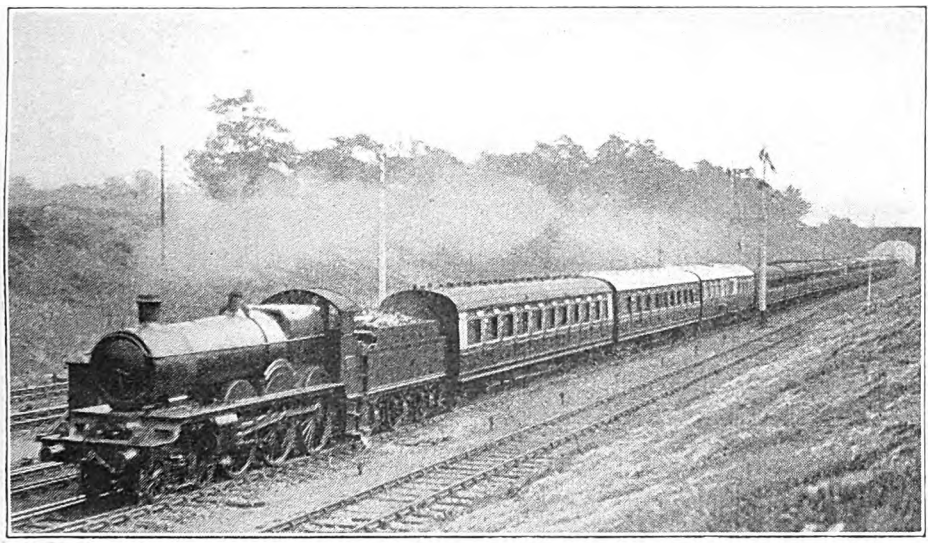

Photo.] DOWN "CORNISH RIVIERA" EXPRESS. [*H. Gordon Tidey.*

Great Western Railway Four-cylinder 4-6-0 Locomotive No. 4061, "Glastonbury Abbey."

at "122¾" was 48½, after which 72½ was touched prior to a long and very severe p.w.r. check right through Castle Cary. Easy running over the Somerton cut-off (which still continues, strangely enough, to be credited in the working book with times so ample that at least 3 min. could be taken from this section to add to excessively hard bookings elsewhere on the journey), with no speed higher than 69 m.p.h., sufficed to take the train through Cogload and Taunton a minute early, and then with a minimum of 31½ m.p.h. at Whiteball, and no higher maximum than 70 afterwards, Exeter was reached dead on time, net time being and passed the latter point 3½ min. early. Then followed a moderate descent to Westbury; in fact, little more of note occurred until the bad check through Taunton, the running over the Somerton cut-off being particularly leisurely. But an excellent ascent was made to Whiteball, and some high speed succeeded to Exeter, which was passed in the fine net time of 172 min. from London. Newton Abbot was passed very slowly 21 min. 40 sec. later, but the rest of the run to Devonport (the first stop on this occasion) was marred by checks, and in addition the log omits to note the times at such essential points as Dainton and Rattery.

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I have also received very scanty details of another run on a similar occasion, when a "Princess"—no number given—with 360 tons to Westbury and 260 thence to Plymouth, passed Southall in 12½ min., Slough in 21 min., Maidenhead in 26 min. 20 sec., Twyford in 32 min. 20 sec., Reading in 37 min., Newbury in 54 min., Westbury in 96 min. 50 sec., Castle Cary in 118 min. 50 sec., Cogload in 137 min. 50 sec. (some fast work was evidently performed over the Somerton cut-off), Taunton in 142 min. 50 sec., Whiteball in 155 min. 50 sec., Exeter in 172 min. 50 sec. (Whiteball-Exeter was another very fast stretch), at Slough. But fine work was again performed beyond Reading, 5-mile stretches in succession from 40 m.p.h. being covered at average speeds of 59·4, 60·0, 60·2, 61·6 and 59·8 m.p.h. (average 60·2 for the 20 miles from "40" nearly to Hungerford); Hungerford was passed at 58½ m.p.h., Bedwyn at 60½, and Savernake at 45. An extremely leisurely descent was made to Westbury, the highest speed attained being only 70 m.p.h., but adverse signals outside Westbury culminated in a dead stand in the station for 30 sec., and involved a loss of 5 minutes.

This loss was, however, practically recovered by Cogload; 51 m.p.h. was

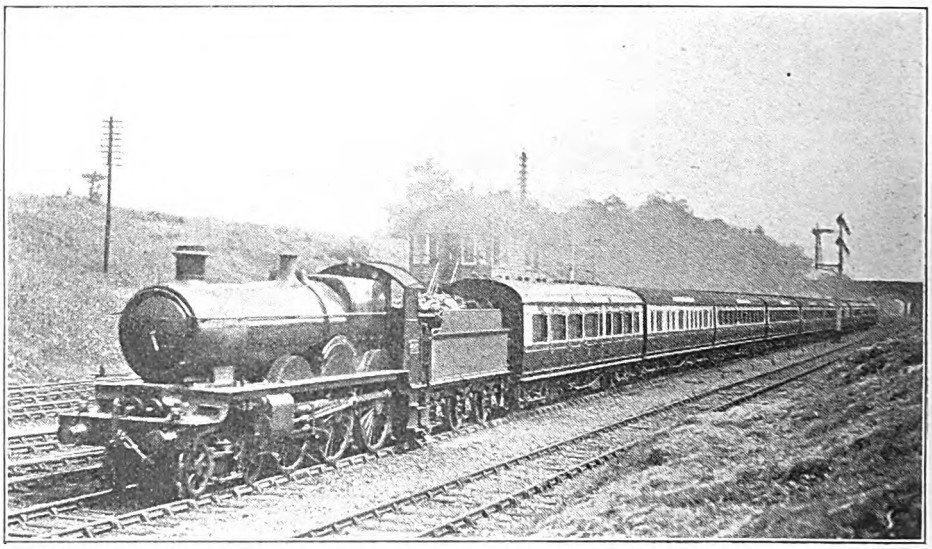

Photo.] DOWN WEST OF ENGLAND EXPRESS. [*H. Gordon Tidey.*

Four-cylinder 4–6–0 Locomotive No. 4036, "Queen Elizabeth."

Newton Abbot in 194 min. 50 sec., and Brent in 217 min. 55 sec., North Road being reached in four hours exactly. It is a pity the recorder could not have troubled to take a little more detail, as such gaps as Newbury-Westbury, Newton-Brent and Brent-Plymouth render the log of very little value.

On No. 3 run, *Princess Mary* had a load not unduly heavy to Westbury, an average load thence to Taunton, and the heaviest load of the series from Taunton to Exeter, in virtue of the train being at no point reduced by slipping. The start to Ealing was brisk, but from there to Reading no higher speed was attained than 67½ m.p.h. attained after Frome, and the minimum at "122¾" was 47; 76 was touched below Bruton, but was reduced to 66 through Castle Cary; and over the Somerton cut-off 65 to 72 m.p.h. was the general speed. But signals were on outside Taunton, occasioning another loss of 1½ min., after which 52 m.p.h. was the highest rate reached prior to the notable minimum speed of 38 m.p.h. at Whiteball (after 2 miles at 1 in 165, 2 miles at 1 in 81-90, and a final ½-mile through the tunnel at 1 in 126). Brisk running followed, with a maximum of 77 m.p.h. past Hele, and despite 6½ min. lost by checks, Exeter would have been reached in 3 hours, or

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a shade under, but for a string of concluding delays.

There now follow the normal "Riviera" trips. In the first of these (column 4) the correspondent concerned supplied me with no details of maximum and minimum speeds on the journey, and it is not therefore possible to say much by way of comment. The chief points about the run are the remarkably good times from Southcote Junction up to Savernake—very little inferior, with 430 tons, to those on the previous journeys with train loads 75 and 145 tons lighter respectively—and similarly both from Frome up to "122¾" and Taunton up to Whiteball, to Exeter in 81 min. 35 sec. start-to-stop.

On run No. 5, *Knight of the Grand Cross* suffered a disheartening sequence of delays, from four lengths of relaying in succession. In this connection, I am reminded that the London and North Eastern Railway is arranging, as far as possible, not to have more than three stretches of any one main line in course of relaying simultaneously, and then only at widely-separated locations, in order to afford a better chance of punctual running; and during the three summer months, if practicable, relaying will be entirely suspended. This praiseworthy example is worthy of imitation.

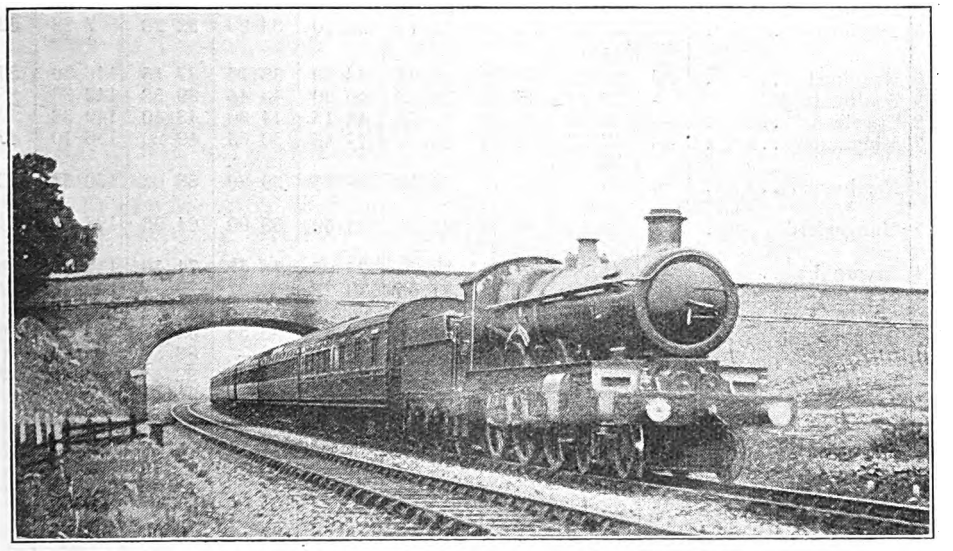

Photo.] DOWN "CORNISH RIVIERA" EXPRESS NEAR TAUNTON. [*W. Rich.*

Four-cylinder 4-6-0 Locomotive No. 4058, "Princess Augusta."

this driver being clearly a specialist in uphill work. At the same time, his downhill and level running, after the special stop at Westbury (in consequence of p.w.r. operations rendering it undesirable to slip), was very free, both between Castle Cary and Cogload, and Whiteball and Exeter; the 4 min. lost by the Westbury stop had, indeed, been recouped by Cogload, despite the fact that the "Riviera" timing has 1 min. less between these points than the bookings of the other 3-hour trains. By this fine running the 95·6 miles from Paddington to Westbury were covered with 430 tons in 97½ min. start-to-stop, and the 78·1 miles thence

On this fifth run a very traditional start was made from Paddington; the difference between the ultra-sanguine expectations of the working time of 11 min. to Southall and the actual average of something nearer 13 min., is always very marked. These leisurely Great Western exits from London, on a perfectly level track, seem all the more inexplicable in view of the brilliant work which invariably follows. At Slough 68½ m.p.h. was the highest rate attained; beyond Reading, 59 at Midgham was the best, and after the Thatcham check, to 15 m.p.h., the speeds were 55½ at Kintbury, 53 at Hungerford, 57½ at Bedwyn, and 45 at Savernake.

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G.W.R.—PADDINGTON–EXETER.

Distance.		Schedule.	1	2	3	4	5	6	7	8
	Run No.		1	2	3	4	5	6	7	8
	Engine No.		4042	4018	4046	4002	4018	4031	4061	4071
	Engine Name		*Prince Albert.*	*Kt. of the Grand+*	*Princess Mary.*	*Evening Star.*	*Kt. of the Grand+*	*Queen Mary.*	*Glastonbury Abbey.*	*Cleeve Abbey.*
	Total Load (tons) To Westbury		285	310	355	430	435	440	400	250
	To Taunton					360	360	365		
	To Exeter ..					295	295	300		
Miles.		min.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.
0·0	Paddington ..	0	0 00	0 00	0 00	0 00	0 00	0 00	37 28	92 55
5·7	Ealing	—	9 27	7 57 sigs.	8 40	9 15	9 25	8 36	30 27	85 00
9·1	Southall	11	12 50	11 22	12 04	12 55	13 05	12 11	27 20	82 05
18·5	Slough	20	21 00	19 59	20 44	21 45	22 00	20 55	18 39	73 45
24·2	Maidenhead	25½	25 50	25 05	26 00	26 55	27 15	26 10	13 34	68 50
31·0	Twyford	31½	31 35 sigs.	31 01	32 13	33 10	33 30	32 28	7 22	62 55
36·0	Reading‖	37	36 25	35 28	37 04	38 10	38 15	37 15	146 30	57 50
37·8	Southcote Jc.‖ ..	—	38 50	37 53	39 43	40 30	40 45	39 58	143 36	55 15
41·2	Theale	—	42 30	41 36	43 25	44 15	44 30	43 40	140 38	52 15
46·7	Midgham	—	47 35 sigs.	46 38	48 50	49 45	50 05 p.w.r.	49 20	136 10	47 50
53·1	Newbury	56	53 55	52 51	55 12	56 15	59 20	56 03	130 52	42 30 sigs.
61·5	Hungerford ..	—	63 10	61 20	63 32	65 00	69 00	64 53	123 52 sigs.	34 55 sigs.
70·1	Savernake	73½	71 58	70 03	72 40	74 05	78 52	74 10	116 00	26 50
75·3	Pewsey	—	76 52 sigs.	75 25	77 55	79 25	84 02	79 18	110 45	21 35
81·1	Patney	—	84 05	80 41	83 00	84 20	88 55	84 16	104 43	16 05
86·9	Lavington	—	89 10	85 30	88 05	89 05	—	88 58	98 12	10 20
91·4	Edington	—	92 50	89 38	92 15	93 00	96 55	92 46	93 45	5 20
95·6	Westbury‖	97½	96 45	93 40	sigs. 97 45 / 98 15	97 30 / 98 30	p.w.r. 102 30	96 45	88 27	0 00
101·3	Frome‖	—	104 00	100 32	108 24	108 20	110 20	104 02	82 01	—
108·5	M.P. 122¾	—	113 17 p.w.r.	109 43	117 35	117 00	119 48	113 30	74 44	—
115·3	Castle Cary ..	120	119 50 p.w.r.	115 48	123 39	123 05	127 52	119 35	66 25	—
125·7	Somerton	—	131 35	126 10	132 55	132 20	137 03	128 51 p.w.r.	56 15	—
131·0	Curry Rivell Jc. ..	—	136 29	131 27	137 35	136 50	141 40	136 52	50 23	—
137·9	Cogload Jc. ..	144†	143 12	138 28 sigs.	144 31 sigs.	143 00	148 05	143 02	43 02	—
142·9	Taunton	149†	148 00	144 42	149 45	148 50	153 00	147 23	37 26 sigs.	—
150·0	Wellington	—	155 10	153 38	158 11	156 25	160 45	154 06	30 55	—
153·8	Whiteball Box ..	—	160 40	158 55	163 19	161 15	166 33 p.w.r.	159 26	27 00	—
158·8	Tiverton Jc. ..	—	165 50	163 22	168 06	166 00	172 32	164 09	20 15	—
165·3	Hele	—	171 43	168 34	173 18	171 30	177 55	169 40	12 28	—
170·2	Stoke Canon ..	—	176 10	172 30	sigs.	176 10	181 50	174 18	6 20	—
173·7	Exeter	180†	180 15	175 40‡	sigs. 188 09	180 05	185 35	178 13‡	0 00	—
173·7	Net times (min.) ..	180†	173¼	172‡	175¾	176	179½	175‡	181*	92§

† Schedule of Town "Riviera" express 1 min. less to these points. * Net time on non-stop basis. ‡ Passing time. § From Westbury, 95·6 miles. ‖ Service slacks: Reading and Southcote Jc., 40 m.p.h.; Westbury and Frome, 30 m.p.h.

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Really fast running followed, with a maximum of 72½ m.p.h. at Pewsey and 80½ at Lavington; in this connection, it is curious to note that "eighties" seem more infrequent over this route than they are over the nearly level Bristol course, while there is no comparison between the maximum speeds attained over this and the Birmingham routes respectively. At mile-post 93½, 2 miles before Westbury, came the second relay check, to 20 m.p.h. The only feeble part of this run was from Westbury to "122¾" with a minimum speed of 41½ m.p.h. at the latter; 17 min. 18 sec. was the time taken for the 12·9 miles concerned. Just beyond the last-named summit came the third "relay," to 20 m.p.h., but good speed was made from Castle Cary to Cogload, with a general average of 67½ to 72½ m.p.h., and a maximum of 75 at Curry Rivell. At Whiteball the minimum was 36 (again quite a good figure), but at Burlescombe the fourth and final relay brought the rate down to 30 m.p.h. After that the best times of the tabulated series were made from Tiverton to Exeter, with a maximum of 76½ m.p.h. at Stoke Canon.

Details of the sixth journey reached me in a very carefully compiled log. For this tremendous load the start to Southall was quite brisk, but speed did not exceed 65 an hour at Slough, and fell to 60 at Sonning. Between Reading and Newbury 58½ m.p.h. was the highest rate attained, and again after Newbury and at Bedwyn; minimum at Savernake was 47 m.p.h. But with maxima of 72½ at Pewsey and 76½ at Lavington, Westbury was passed ¾ minute on the right side of time. Minimum at "122¾" was 45½ m.p.h., and then, with a maximum of 74 m.p.h. at Bruton, and no slack at Castle Cary, despite a bad relay caution right through Somerton Tunnel, Cogload was passed dead on time. After Taunton speed fell to 67 m.p.h. at Norton Fitzwarren, 60 at Poole Siding, 53½ at Wellington and the minimum to Whiteball was 37 m.p.h. From there the maximum to Exeter was a sustained 74 near Collumpton.

After Exeter, with a load now of 225 tons only, *Queen Mary* ran the 12·2 miles to Dawlish in 13 min. 13 sec., with a maximum of 65 m.p.h., and the 8 miles on to Newton Abbot, where speed was reduced to 30 m.p.h., in 9 min. 12 sec. The 3·8 miles from Newton up to Dainton occupied 6 min. 50 sec., with a minimum of 20·7 m.p.h. on the concluding 1¾ miles at 1 in 57–43; and the 4·8 miles down to Totnes were run very cautiously in 5 min. 37 sec. Then came the ascent to Rattery, with its 4 miles at 1 in 48–90 (with 1¾ continuously at 1 in 50), on which speed fell to 24·5 m.p.h.; the 4·6 miles from Totnes to Rattery took 8 min. 8 sec., the 2·3 miles thence to Brent 3 min. 12 sec., and the 2·2 miles on to Wrangaton Summit 2 min. 35 sec.; after that speed was not allowed to exceed 57½ m.p.h. to Hemerdon (7·4 miles in 8 min. 25 sec.), although 68 was touched momentarily in the descent of Hemerdon bank, the 6·7 miles from Hemerdon to the stop at North Road taking 8 min. exactly. Thus the total time for the 225·7 miles from Paddington to Plymouth was 243 min. 25 sec., instead of the 247 min. allowed.

I have bare details of yet another run on the down "Riviera," wherein Driver Springthorpe—the hero of the exploits of *Polar Star* over the L. & N.W.R. thirteen years ago, and the presiding genius on that amazing run of my own on the "Riviera" express, which figured in my article for December, 1921—was on the footplate of No. 4042, *Prince Albert*, with a 14-coach train behind him taring no less than 489 tons, and therefore weighing in all probability quite 525 tons to Westbury. After this the usual slips were made, leaving 450 tons to Taunton, 385 tons to Exeter, and 310 tons on to Plymouth, but no assistance was taken at any point. A distinguished railway party was on board, and Chief Inspector Flewellen (who, by the way, travelled from Plymouth to London on the footplate on the epoch-making journey with the mails of May 9, 1904) was on the footplate. The times which follow are taken from the journal, and are therefore approximate. Slough was passed in 23 min., Reading in 40 min., Newbury in 58 min., Savernake in 76 min., Westbury in 97½ min. (on time), Castle Cary in 122 min., Taunton in 148 min., Exeter in 180 min., Newton in 203 min., Brent in 223 min., and Plymouth was reached in 244 min., 3 min. early—a veritable triumph of achievement, which I only wish it had been my good fortune to record in detail

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personally. It will be seen that the favourable length from Savernake was employed, and legitimately so, to recover the 2½ min. lost with this tremendous train to Westbury; but perhaps the finest work of the journey was that embodied in a time of only 41 min. with a 310-ton train over the mountainous grades between Newton Abbot and Plymouth. All honour to designer, driver and fireman!

And now for the up journeys. The interest of the first lies in the fact that all but up "Riviera" times were worked to with a 400-ton train load. It is probably known to most Great Western enthusiasts that Exeter–Paddington in three hours is a distinctly harder proposition than Paddington-Exeter in the same time, principally, I imagine, owing to the adverse gradients being spread out over much longer sections of line on the up than on the down journey. So *Glastonbury Abbey* had no light task before her. Best speeds reached on the climb to Whiteball were 52 on both the slight descents to Hele and past Tiverton Junction, and the minimum at Whiteball, after 2 miles at 1 in 258–189 and 2¼ at 1 in 115, was 37 m.p.h. In descending to Taunton, a maximum of 80 was reached, but was cut short by a bad signal check below Norton Fitzwarren, costing 1½ min. After Taunton, 59 m.p.h. was attained, but reduced to 50 over Cogload Junction; speed then varied from 62 at Curry Rivell to 48 at Somerton Tunnel, 66 at Keinton Mandeville, 60 at Castle Cary, and 36 at "122¾" summit, with a brief spell at 71 before the Frome and Westbury slacks, between which 68 m.p.h. was touched.

After Westbury speed rose to 63 m.p.h. on the level length past Edington, but fell to 49 on the 5 miles at 1 in 222 from Lavington to near Patney; it then rose to 62 on the slight descent before Pewsey, and fell finally to 56 on the concluding stretch to Savernake. From there some fast work was performed down to Reading, the 24 miles between posts 64 and 40 being covered in 1 sec. under 20 min., at an average a shade over 72 m.p.h.; maximum was 75 an hour at Newbury. The signal check at Bedwyn was very slight indeed. Beyond Reading, again, a very smart run to Paddington, entirely free from checks, was made in 37 min. 28 sec. for the 36 miles, start-to-stop; 5 mile stretches from post "36" were run successively in 4 min. 32 sec., 4 min. 23 sec., 4 min. 28 sec., 4 min. 42 sec., and 4 min. 39 sec., maximum speed being 70 m.p.h. near Slough. On a non-stop basis I make the net Exeter–Paddington time 181 min.

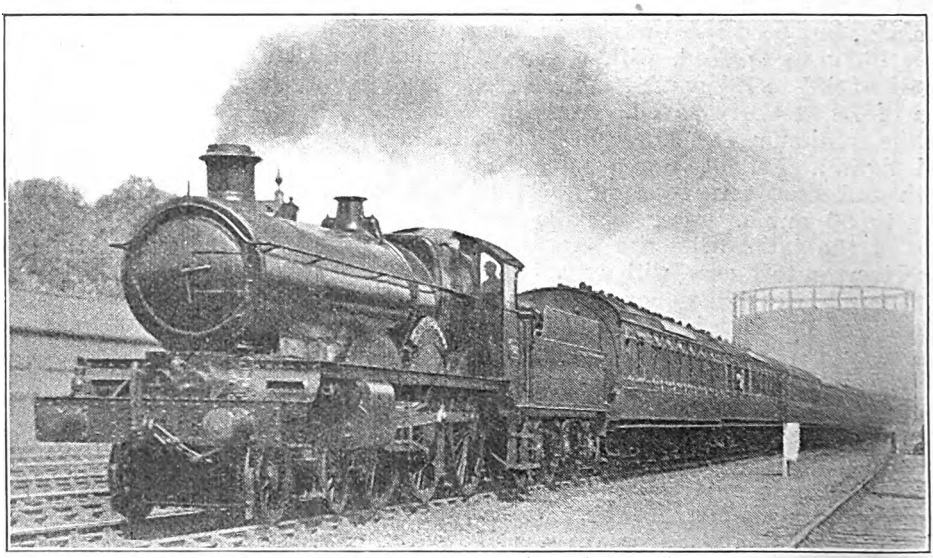

Photo.] DOWN BRISTOL RESTAURANT CAR EXPRESS. [*F. E. Mackay.*

Four-cylinder 4-6-0 Locomotive No. 4026, "King Richard."

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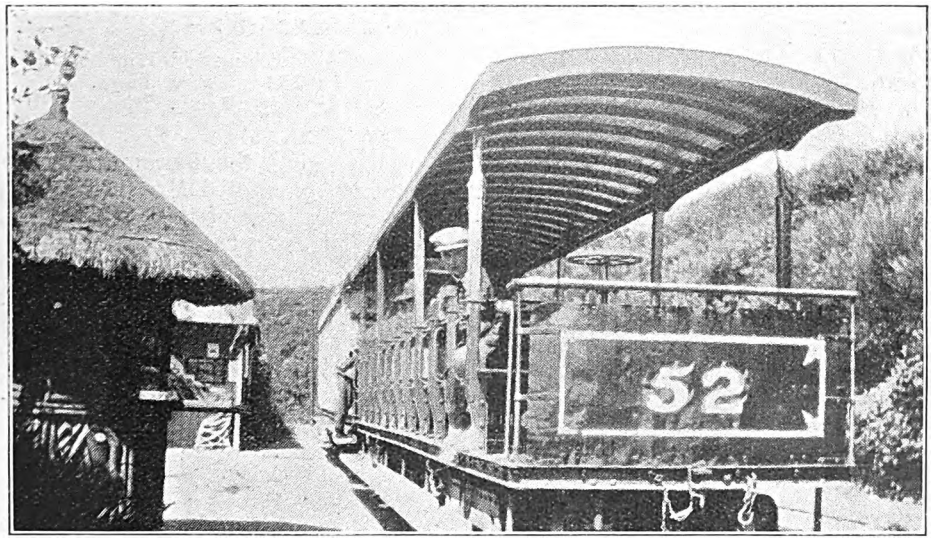
Lastly comes the smart run of *Cleeve Abbey* with a light train from Westbury to Paddington, with its gain of 7 min. on schedule, and net gain of 8 min. That is to say, the journey of 95·6 miles was completed in 92 min. 55 sec. gross, and 92 min. net. Here again it is unfortunate that no *en route* speeds figure in the log. A fine ascent was made to Savernake, and then, allowing for the two very slight signal checks, which between them accounted for a bare minute, the speeds down to Reading were an almost exact counterpart of those on the preceding journey. From Twyford on to Ealing the running was a little faster, but the final time in from Ealing was, on the other hand, a minute slower. I had hoped to carry on further with a series of runs over the north to west route, which, in point of fact, I had tabulated ready for use, but as I have now arrived at the limits of my available space, further Great Western runs must be held over for the moment.

ELECTRIC TRACTION IN THE ISLE OF MAN.



MR. G. WARD, of Smethwick, Birmingham, sends two photographs of electric trains in the Isle of Man. One showing a two-coach train on the Manx Electric Railway at Garwick station, on the Douglas-Ramsay main line, is reproduced. This railway has 18 miles on the 3 ft. gauge and 4·9 miles on the 3 ft. 6 in. gauge. There are 34 passenger motor cars, 29 trailer cars, and 28 goods wagons and mail vans. As will be seen from the illustration, the vehicles used in summer, when the railway becomes a very busy one, are largely of open-observation type. The other photograph forwarded by Mr. Ward would not reproduce satisfactorily, though it may be mentioned. It is taken on the Groundle Glen miniature railway, and shows a 2-2-2-2 electric locomotive recently placed in service, named *Sea Lion*.

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Royal Visit to Swindon Works,

APRIL 28, 1924.

THE Swindon Works of the Great Western Railway Company were, on Monday, April 28, honoured by an informal visit from their Majesties the King and Queen. This, we understand, is the first time that Swindon has thus been visited. The Royal train arrived shortly after 2 p.m., and their Majesties were received at the station by Viscount Long, the Lord Lieutenant of Wiltshire, and Lady Long. The King and Queen were accompanied by Colonel Clive Wigram (Assistant Private Secretary), Lady Minto (Lady-in-Waiting to the Queen), and Major Reginald Seymour (Equerry-in-Waiting).

The Directors and Officers of the Great Western Railway Company who travelled in the Royal train were: The Viscount Churchill, G.C.V.O., Chairman; Sir S. Ernest Palmer, Bart., Deputy Chairman; Sir Felix J. C. Pole, General Manager; Mr. R. H. Nicholls, C.B.E., Superintendent of the Line; Mr. A. E. Bolter, Secretary; Mr. J. C. Lloyd, Joint Chief Engineer; Mr. J. H. Matthews, Chief of Police; Mr. G. J. Walker, Hotels and Refreshment Rooms Manager; Mr. C. Crump, Locomotive Running Superintendent. Mr. F. R. Potter, London Divisional Superintendent, also travelled in the Royal train, and the arrangements at Swindon station were under the general supervision of Mr. H. R. Griffiths, the Bristol Divisional Superintendent.

On arrival at Swindon station the Lord Lieutenant presented to their Majesties the Mayor and Mayoress of Swindon (Mr. and Mrs. T. C. Newman); the Town Clerk (Mr. R. Hilton); Mr. R. Mitchell Banks, K.C., M.P. for the Swindon Division of Wiltshire; Mr. C. B. Collett (Chief Mechanical Engineer, Great Western Railway).

Their Majesties then drove from Swindon station to the Cenotaph, on which the King placed a wreath. The procession then proceeded to the Town Hall, where they were received by the Mayor, and thence to the Victoria Hospital, where a portion of the new building was inspected. They next visited the G.W.R. Medical Fund Surgery, and then proceeded to Swindon Works, passing *en route* the G.W.R. Hospital and Mechanics' Institution. Outside the latter were lined up about 200 retired servants of the company.

On arrival at Swindon Works their Majesties were received by Mr. C. B. Collett, Chief Mechanical Engineer, who presented Mr. W. A. Stanier, Assistant Mechanical Engineer, and Mr. E. T. J. Evans, Manager of the Carriage and Wagon Works. They then proceeded on a tour of the Carriage Works, the following shops being visited :—

Carriage Finishing and Trimming Shops.
Polishing and Finishing Shops.
Carriage Body-making.
Saw Mill.

On reaching the Locomotive Works, Mr. Collett presented Mr. R. A. G. Hannington, Manager of the Works.

Their Majesties then inspected :—

The Iron Foundry.
Engine being turned on Balance Turn-Table.
Types of Engines in Yard.
Engine Testing Plant.
General Machine Shop.
Engine Erecting Shop.
Complete Engine being lifted by overhead crane.
Wheel Shop.
Wheel Balancing.
Weighbridge.

Adjacent to the weighbridge were eighty men who are still at work in the factory, each having over fifty years' service.

As the King and Queen had expressed a special desire to see the men at work, the various shops were, as far as possible, in operation as usual. In the carriage-finishing and trimming shops their Majesties were particularly interested in two new third-class coaches, one a restaurant car. In the iron foundry a mould had been prepared, showing the words, "Welcome to the King and Queen," with the words *ad unum omnes* and decorative devices. Crossing the main line the King

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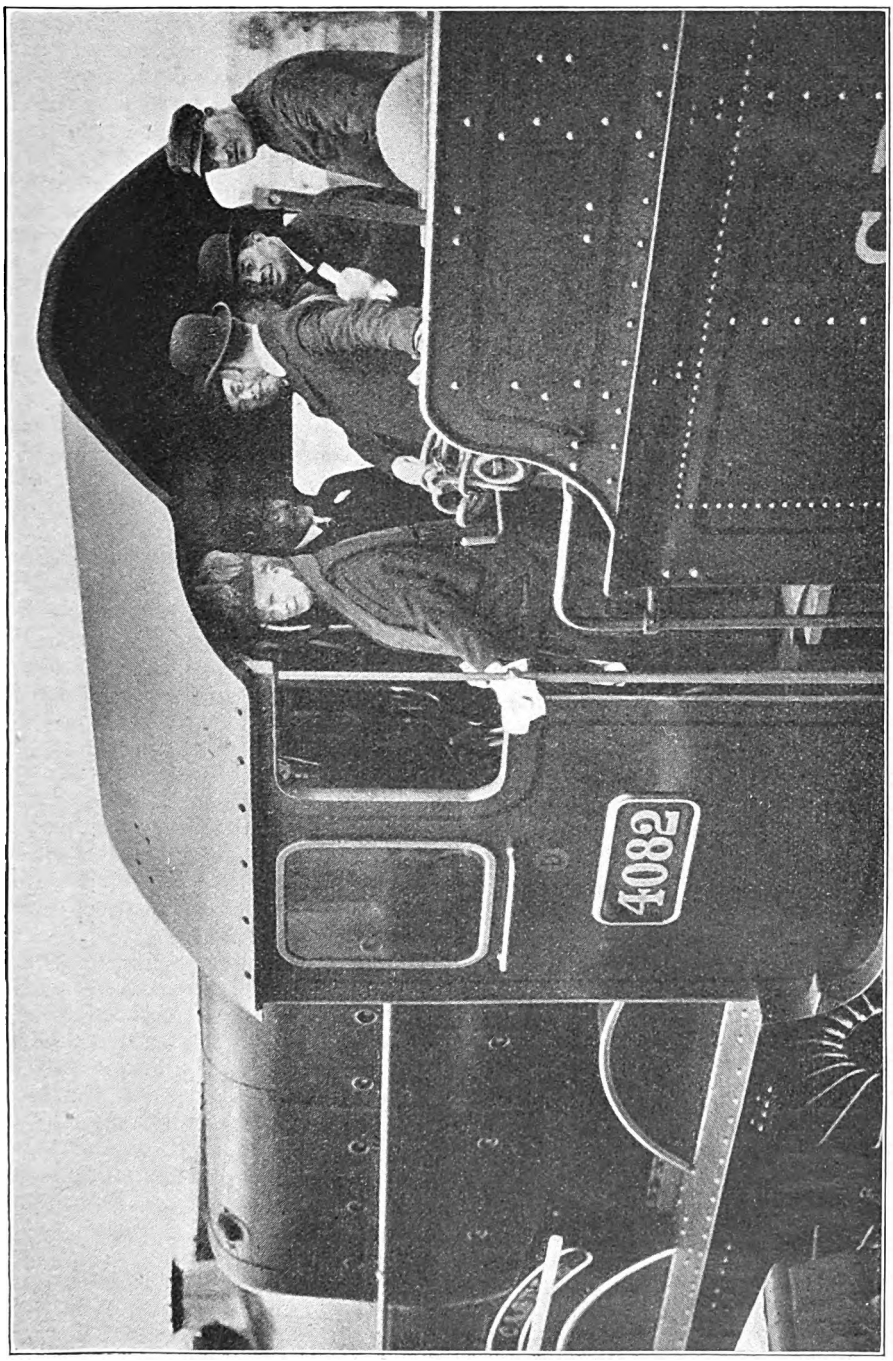

Photo.] THEIR MAJESTIES ON THE FOOTPLATE OF No. 4082, "WINDSOR CASTLE." [*Topical.*

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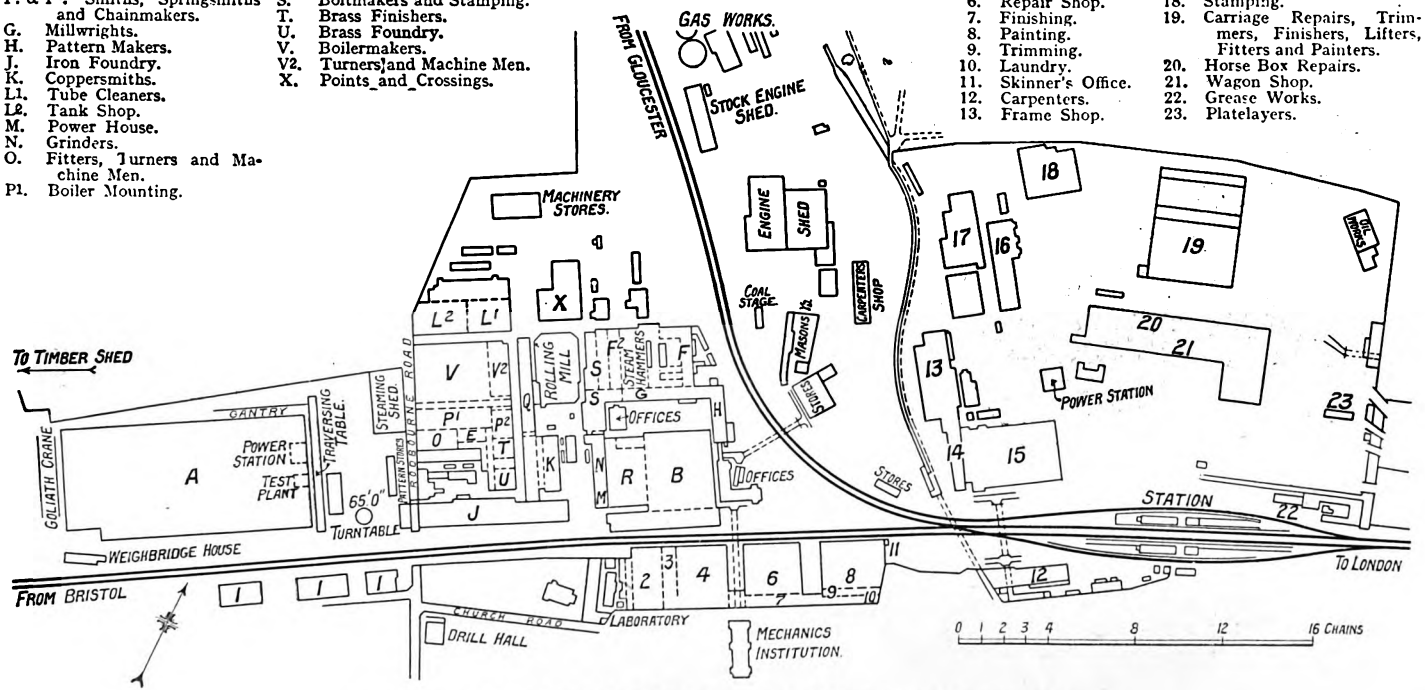
A. Erectors and Machine Shop.
B. Erectors, Boilersmiths and Tender Shop.
E. Electrical Shop.
F. & F². Smiths, Springsmiths and Chainmakers.
G. Millwrights.
H. Pattern Makers.
J. Iron Foundry.
K. Coppersmiths.
L¹. Tube Cleaners.
L². Tank Shop.
M. Power House.
N. Grinders.
O. Fitters, Turners and Machine Men.
P¹. Boiler Mounting.
P². Turners and Machine Men.
Q. Angle Iron Smiths.
R. Fitters, Turners and Machine Men.
S. Boltmakers and Stamping.
T. Brass Finishers.
U. Brass Foundry.
V. Boilermakers.
V². Turners and Machine Men.
X. Points and Crossings.

1. Timber Yard.
2. Saw Mill.
3. Fitting.
4. Body Shop.
6. Repair Shop.
7. Finishing.
8. Painting.
9. Trimming.
10. Laundry.
11. Skinner's Office.
12. Carpenters.
13. Frame Shop.
14. Smiths.
15. Fitting.
16. Wheel Shop.
17. Road Wagon Shop.
18. Stamping.
19. Carriage Repairs, Trimmers, Finishers, Lifters, Fitters and Painters.
20. Horse Box Repairs.
21. Wagon Shop.
22. Grease Works.
23. Platelayers.



GENERAL PLAN OF SWINDON WORKS, GREAT WESTERN RAILWAY.

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was instructed in the art of turning locomotives by means of the large electric turntable. Their Majesties were also shown a new locomotive under test in the test shop, and in the erecting shop a complete locomotive was lifted and placed in position by means of overhead travelling cranes. Returning to the Royal train, which was standing adjacent to the works, their Majesties ascended to the footplate of one of the new "Castle" class locomotives, *Windsor Castle*, and accompanied by Lord Churchill, Sir Felix Pole and Mr. Collett, Inspector Flewellyn and the driver and the fireman, the engine was placed in His Majesty's charge for the journey from the siding to the station. On leaving the locomotive their Majesties specially thanked Inspector Flewellyn, Driver E. Rowe and Fireman A. Cooke, and congratulated the last named on his four years' military service in the Royal Engineers. After expressing their appreciation of the arrangements made and the interest they had taken, their Majesties entered the Royal saloon for the return journey to Windsor.

Established in 1842, Swindon Works have many times been extended, and today they are amongst the largest in the world, occupying an area of 310 acres, of which 65 are roofed. The works are situated on the north side of the main line to Bristol and the West of England. About 7,500 men are employed in this section, which comprises fitting, erecting and machine shops, iron and brass foundries, also smiths', stamping, coppersmiths', boilersmiths', tinsmiths' shops, &c. The extent of the locomotive establishment will be gathered from the fact that nearly 1,000 locomotives are repaired each year, while the capacity for constructing new locomotives is approximately two per week. In the fitting shops the operations undertaken are those of assembling and preparing the motion parts, such as connecting rods, eccentric rods, straps and sheaves, together with cylinders and valves.

The principal shop is the new "A" erecting and machine shop, the area of which is 502,000 sq. ft. The equipment includes four 100-ton electrically-driven overhead travelling cranes of 75-ft. span for lifting modern heavy engines. An interesting feature of this shop is the wheel balancing machine, an ingenious device for ensuring correct balance of the wheels of the locomotives. The results obtained from this machine have been of the utmost service in producing smooth running and working of the engines. Another important part of the equipment is the locomotive testing plant, by means of which a locomotive before being placed in traffic can be tested under virtually service conditions.

The main boiler shop is equipped with pneumatic riveters and caulkers, hydraulic riveters and presses (flanging and bending), furnaces, &c. Special operations are those of shaping boiler plates in a cold state, and the stretching of tubes that have already been used. For many years past forgings have been produced by the process of drop-stamping; by this means the forgings are made in a rapid and clean manner, thus avoiding the necessity for machining. Extensive use is also made of acetylene and electric welding processes. A feature of the latest development of the heat treatment of metals is the heat treatment shop. Particular attention has been paid to the technical side of engineering at Swindon, provision in this connection being the chemical laboratory (including a research department) and the testing house.

The carriage works are situated on the opposite (the south) side of the line, whilst the wagon works lie to the north-east. The carriage and wagon works comprise :— saw mill, body, repair, finishing, painting, trimming, wheel, fitting and smiths' shops. About 5,600 men are employed in this section. The capacity for output of the carriage works during a year is 200 passenger vehicles of various types, whilst that for repairs is 5,000 coaches per annum, 3,000 being in the nature of heavy repairs. The wagon works are capable of constructing 4,500 new wagons annually, while the repair capacity is about 8,000 wagons per annum.

One of the most interesting features of the carriage and wagon works is the new saw mill and timber drying shed. The saw mill is provided with an arrangement whereby the electric current required for operating the mill is produced by a generator driven by a gas engine, the gas being obtained from a gas suction plant fed by mill refuse. The timber drying apparatus

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is on the Sturtevant compartment system, the results being on the whole very satisfactory. In a successful artificial seasoning plant there are three essentials, viz., air circulation, heat and moisture; each of these is secured in the system employed at Swindon.

Female labour is not very extensively employed in the Swindon Works, the exceptions being the employees at the laundry, some machinists and lining sewers, and a comparatively small number in the polishing shop. In the latter shop the operations are interesting by reason of their variety, the articles dealt with by the female polishers embracing:—frames for mirrors and notices, net rods, beading, inside of compartment doors, sliding doors, moulding of all kinds, panelling, tablets, &c. Female machinists and lining sewers are engaged in the making of aprons, canvas bags, table cloths, towels, flags, axle-box pads, pillows and slips, &c. Laundry work is not usually associated with the mechanical department of a railway, but so far as the Swindon Works are concerned, the existence of a well-equipped laundry is indicative of the many-sided usefulness of Swindon to the railway generally. In this depot the laundering of towels, dusters, antimacassars and many other articles is undertaken. During last year 2,650,000 articles passed through the laundry.

Power for the works generally is provided by 16 gas engines coupled direct to electric generators working at 250 volts, the total horse-power of the plant being about 4,640. The company make their own gas at Swindon, and, in this connection, some little time ago a new gas works on the vertical retort system was brought into use. This plant is capable of producing 3,000,000 cubic ft. of gas each 24 hours, and is the largest privately-owned plant of its kind in the world.

In addition to the construction and repair of locomotives, carriages and wagons, a great variety of other work is done at Swindon. Large quantities of castings are made for signalling work, also the points and crossings required for the permanent way, &c. The repairs to pumping and hydraulic machinery in use at the various works and stations of the company are also carried out at Swindon.

The Swindon Works are under the control of the Great Western Railway Company's Chief Mechanical Engineer, Mr. C. B. Collett, O.B.E., M.Inst.C.E., M.I.Mech.E., who is also responsible for the supervision of all mechanical engineering work throughout the system. The total staff employed in this department numbers nearly 45,000.

The Great Western Railway Mechanics' Institution was founded in 1844 "for the purpose of disseminating useful knowledge and encouraging rational amusement amongst all classes of people employed by the Great Western Railway Company." In connection with the Institution there is a fine library, containing 50,000 volumes. Reading rooms, separate recreation rooms for billiards, chess and draughts, a large hall for musical and other entertainments, and a lecture hall, form part of the Institution. The management is in the hands of an elected committee of foremen and other employees. An interesting feature in connection with this Institution is that under its auspices the "Annual Trip" or "Works' Holiday" is conducted. The directors provide, free of all cost, the requisite number of trains, and an idea of the extent of this function may be gained from the fact that each year some 26,500 employees, wives and dependants, participate. The "Trip" was established in 1849, the number taking part on that occasion being 500.

The Great Western Railway Medical Fund Society was established in 1847 for the purpose of providing medical and surgical attendance and medicine for the members of the Society and their families. Membership of the Society totals nearly 15,500, which number, with the addition of wives and dependants, represents a total of between 38,000 and 40,000 for which the Society accepts obligation in regard to medical and surgical attendance as required.

A relative, though independent, society is the Great Western Railway Locomotive and Carriage Department Sick Fund Society. This was established in 1844 by the employees for the purpose of providing allowances during illness, together with a superannuation allowance on retirement. The number of members is 7,261.

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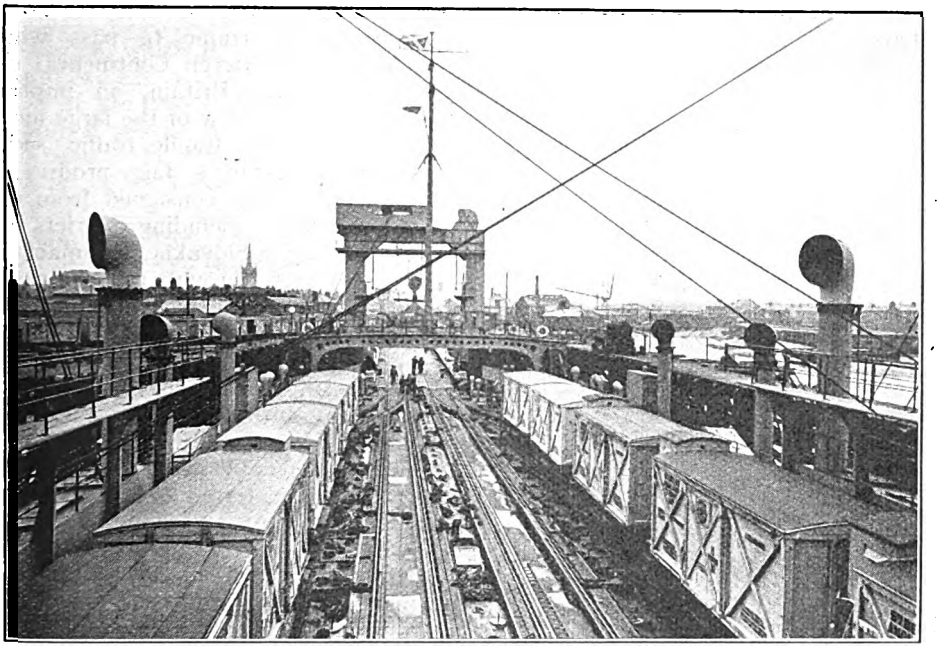

VIEW ON DECK OF TRAIN FERRY STEAMER.

The Harwich-Zeebrugge Train Ferry.

THIS undertaking, which was formally opened on April 24 by H.R.H. Prince George, has several times been referred to, while progress has been recorded on various occasions. Now that the scheme has reached completion, the time is ripe for further description, in which connection we have to acknowledge the courteous assistance of Great Eastern Train Ferries Ltd., of 17, Eldon Street, London, E.C. 2; Colonel A. J. Barry, C.B.E., M.Inst.C.E. (of the firm of A. J. Barry & Partners, Consulting Engineers), and the Continental Traffic Department of the London & North Eastern Railway (Great Eastern Section), which deals with traffic matters on the English side.

The company was formed at the beginning of last year, and in March an issue of £400,000 ordinary shares of £1 each was made. Lord Daryngton, P.C., is Chairman of the Company, and Lord Ailwyn (a director of the London and North Eastern Railway) represents that company on the board. Co-operating with Great Eastern Train Ferries Ltd. is a Belgian company, "La Société Belgo-Anglaise des Ferry Boats." The English company has acquired the three train ferry boats which were built for the Government in 1917 by Armstrong, Whitworth & Co. and the Fairfield Shipbuilding & Engineering Company, at a total cost of about £560,000. The entire management and control of the Harwich-Zeebrugge service is in the hands of the London and North Eastern Railway Company. The Belgian Government have placed at the disposal of the Belgian company some thousands of wagons specially adapted for running on British railways, including those used for through services *via* the Richborough-Calais and Southampton-Dieppe train ferries during the war.

At Harwich a berth for the train-ferry steamers has been provided adjacent to the pier which was used by Great Eastern Railway Continental steamers before they were transferred to Parkeston Quay. The cost at this end is about £60,000. At Zeebrugge a new jetty has been built at a cost of about 1,000,000 frs. The

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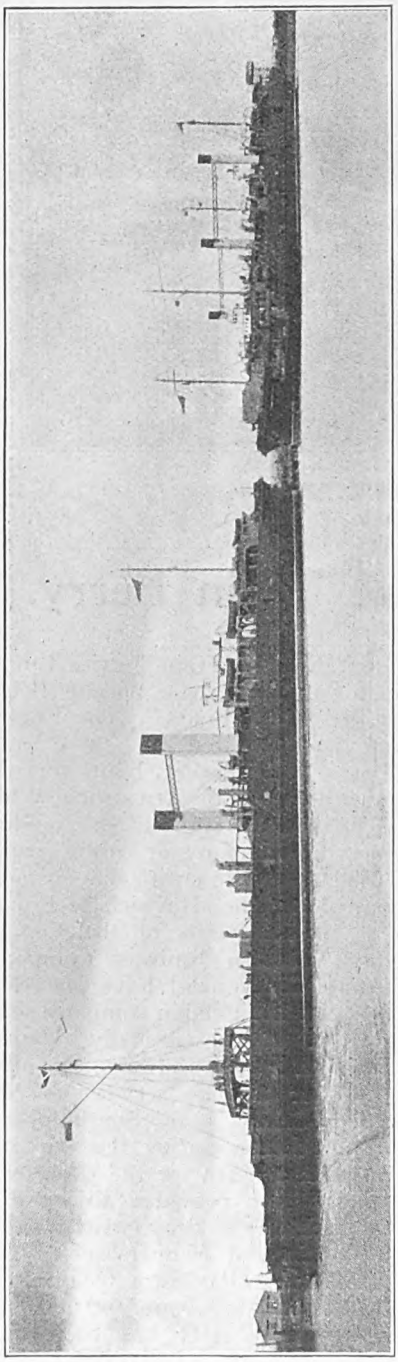
capacity of each train-ferry vessel is 54 10-ton wagons. The scheme is the outcome of proposals initiated by Colonel A. J. Barry, mentioned above.

The great value of this service is that it will enable traffic to pass without transhipment between Continental countries and Great Britain, an important consideration in view of the large amount of perishable and fragile traffic, such as eggs, fruit, vegetables, dairy produce, &c., which is regularly consigned from many parts of Europe, including districts as far away as Czecho-Slovakia, Roumania and Italy. In fact, through rail communication will be practicable with most parts of Europe, except Spain, Portugal and Russia, where the gauges are different, and it is anticipated that a considerable amount of entirely new traffic will be created owing to the fact that through running will enable traffic to pass which at present is deterred owing to the need for transhipment and handling *en route*. There will be considerable benefit to British manufacturers, in that goods of a more or less fragile character, such as sanitary ware, and many other items, will be able to pass without transhipment, and this will also be an advantage in regard to general goods, in that the cost and delay of transhipment will be avoided, together with claims for damage, pilferage and delay, which are always liable to result from repeated handling. Another aspect which may be suggested is that of the delivery of railway rolling-stock, which will be able to pass, by selected routes if too large for general routing, direct from British works to Continental destinations, without need for dismantling and re-erection on delivery, or expensive craning, as is usually only practicable at the larger ports. Road vehicles, agricultural machinery and other bulky consignments will also be suitable for transport intact.



[*Topical.*

GENERAL VIEW OF TRAIN FERRY STEAMERS.

Photo.]

The Southampton train-ferry berth, which was acquired by Great Eastern Train Ferries Ltd., has been re-erected at Harwich. The ferry-steamer berth has on each side an arm or jetty constructed of steel piles. The longer arm is 450 ft. in length; the shorter arm is 110 ft. long. The wagons are pushed on to the stern of the ferry steamer over a communication bridge, which fills the space at the shore end separating the two piers of the berth. The Harwich communication bridge measures 120 ft. centre to centre of bearings, and carries two railway tracks 4 ft. 8½ in. gauge, set 11 ft. 6 in. centre to centre.

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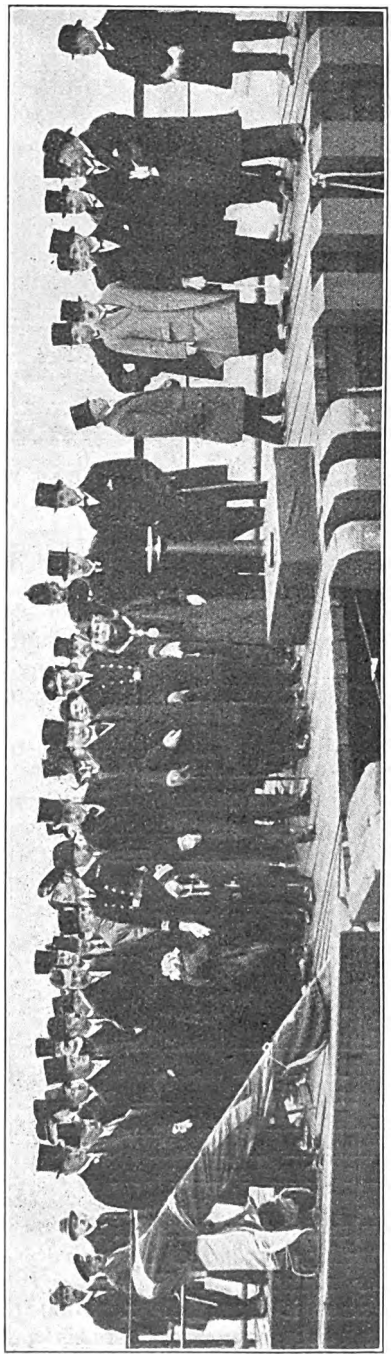
The bridge, which is constructed of steel girders, weighs about 200 tons. It is hinged at the land end to allow the other end to rise and fall according to the state of the tide; the attachment is such that a list of about 5 degrees can take place either to port or starboard, so as to adapt the communication bridge to the movements of the ferry steamer in the berth. The communication bridge is suspended from two steel towers 42 ft. high, with a base 5 ft. 6 in. sq. These towers are placed 36 ft. 6 in. apart between centres. The ferry-boat end of the communication bridge is supported by four steel-wire ropes working over pulleys and having counterweights attached at their outer ends. The counterweights are suspended in the legs of the towers, in which, to prevent fouling, timber rubbing pieces are provided.

The raising or lowering of the outer end of the communication bridge is performed by a winding drum actuated through worm and spur gearing by a 20-b.h.p. electric motor. As a stand-by, hand gear to raise or lower the bridge is provided; two men can easily operate the hand apparatus.

The three train-ferry steamers acquired by Great Eastern Train Ferries Ltd. were built in 1917, and have been reconditioned and brought up to Lloyd's present requirements. Two were built by Sir W. G. Armstrong, Whitworth & Co. Ltd., at Elswick, and the other by the Fairfield Shipbuilding & Engineering Co. Ltd., of Govan. All three are built of mild steel, in accordance with the requirements of Lloyd's for cross-Channel steamers, and were constructed under Lloyd's special survey and official inspection.

Chief dimensions of the ferry steamers are: length overall, 363½ ft.; width, 61½ ft.; mean draught with full load, 9½ ft.; displacement, 3,654 tons; cargo capacity, 850 tons; speed, 12 knots. On the railway deck the two sets of rails which connect with the tracks on the communication bridge within a few yards branch into four tracks of a total length of 1,112 ft., capable of carrying 54 10-ton "common-user" railway wagons. The train-ferry steamers have two funnels side by side about the centre of the vessel and at the extreme edges. The navigating bridge, &c., are between the funnels, above the deck on which are carried the railway wagons.

The vessels are driven by twin screws, the engines being triple-expansion, working



H.R.H. PRINCE GEORGE AND GROUP OF DIRECTORS AND OFFICERS.

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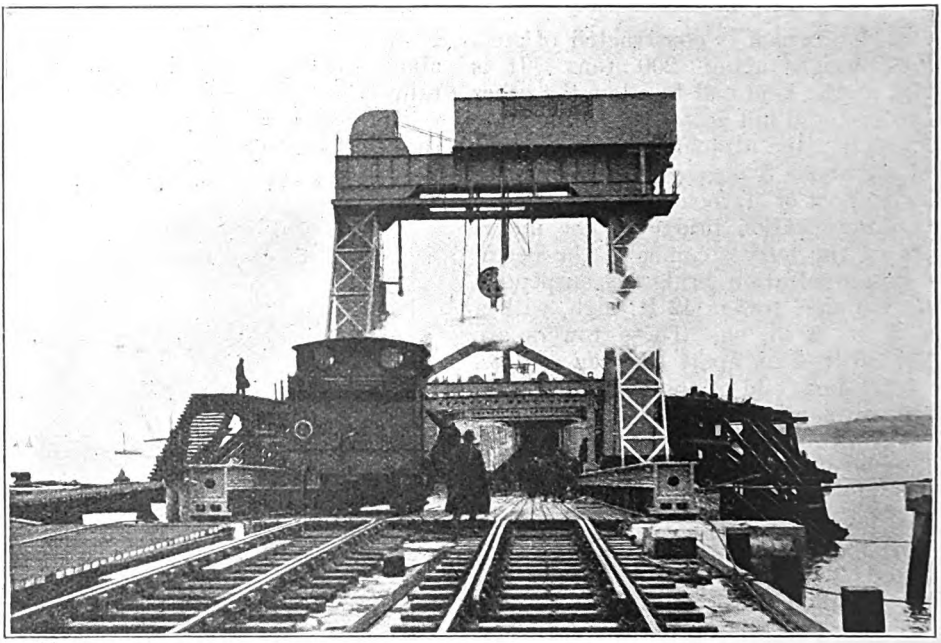

LOADING RAILWAY WAGONS ON FERRY STEAMER.

at 180 lb. steam pressure. There are four single-ended boilers, oil-fired and fitted with Howden's forced draught. A pair of boilers is on each side of the ship; between the boilers are located longitudinally two oil-fuel tanks. Allowing 38 cubic feet per ton for the oil, the total capacity of the tanks is 80 tons.

The British Commissioners for Customs and Excise have arranged that goods forwarded in padlocked wagons under Customs seal can be examined for Customs purposes at inland British railway stations (this arrangement will at first be limited to London), approved by the Customs authorities, instead of at Harwich. Reduced port dues have been granted to the train ferries both at Harwich and Zeebrugge.

The London and North Eastern Railway has provided free of rent the land required for the train-ferry terminal at Harwich, and has also constructed gratuitously the rail connection at Harwich between the L. and N.E.R. system and the ferry terminal. It is proposed to allocate two steamers, making six round trips per week, to the traffic, estimated to convey 480 tons per round trip. The capacity of one steamer is from 800 to 1,000 tons per round trip, so that there is a big margin provided by the three ferry steamers for a very considerable expansion of traffic.

At Harwich use is made of the existing connections between the goods yard alongside Harwich (Town) station and what is known as the "New Pier," though it has been in use for many years. Certain track alterations have been made to suit the location of the train-ferry berth. As there are sidings available at the Town station it has not been necessary to add to the storage facilities to any great extent.

At Zeebrugge a berth has been provided in an arm of the harbour, and a connecting line laid from the berth to the Belgian State lines serving the docks. Most of the surrounding land is low-lying, much of it reclaimed within embankments, so that a certain amount of additional reclamation and embankment work has been entailed, both for the ferry-berth approach and for storage sidings and the connecting lines. The ferry berth has been built out from the embankment wall, but is otherwise of ordinary steel, timber and concrete construction.

The service was formally inaugurated on Thursday, April 24, by H.R.H. Prince

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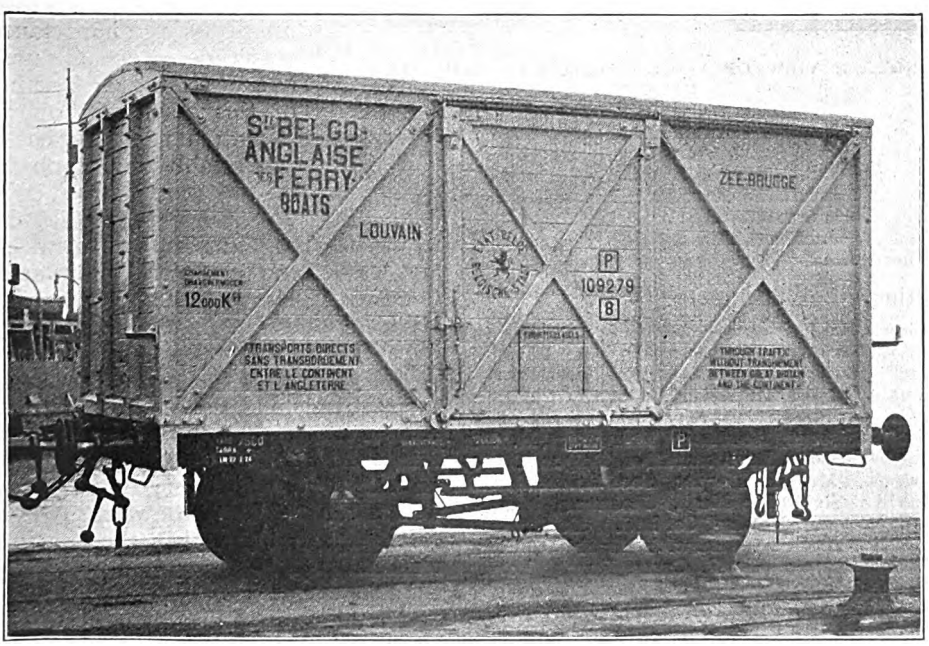
George. To accommodate the guests and press representatives the London and North Eastern Railway Company ran a special train, leaving Liverpool Street at 9.50 a.m., arriving Harwich station at 11.23 a.m. Prince George was received on his arrival at Harwich by large numbers of the townspeople, and on their behalf the Mayor (Mrs. Lucy Hill) presented an address of welcome to His Royal Highness, in which he was reminded that the ancient borough of Harwich had on more than one occasion been honoured with a visit from his father and grandfather, and many other illustrious ancestors. The Prince also received the High Sheriff of Essex (Sir Carne Rasch), and inspected a guard of honour formed by the Harwich Battery of the Royal Garrison Artillery.

The berth and the train ferry were then inspected, and a number of wagons, laden with goods and agricultural implements, were propelled by a shunting engine on to the train ferry. Prince George then operated the control gear raising the bridge. The band played the British and Belgian national anthems, and the train ferry steamed from the berth on its voyage to Zeebrugge, where on Friday the Belgian official opening was performed by Prince Leopold, Duke of Brabant.

Following the opening ceremony at Harwich, the guests—who included, besides Prince George and suite, ambassadors and other representatives of British and foreign Governments, directors and officers of the Great Eastern Train Ferries Ltd., the Belgian Company (Société Belgo-Anglaise des Ferry Boats) and the London and North Eastern Railway Company, and press representatives—were then conveyed by special steamer from Harwich to Felixstowe Pier and thence by motor-cars to the Felix Hotel, where they were entertained to luncheon.

Owing to illness, Lord Daryngton, Chairman of the Great Eastern Train Ferries Ltd., was unable to be present. Those present included :—

H.R.H. Prince George and suite; Mr. H. T. Bailey, the Hon. Rupert Evelyn Beckett, Sir Hugh Bell, Bart., C.B., Mr. W. K. Whigham, Sir Eric Hambro, K.B.E., directors of the London & North Eastern Railway Company; Mr. R. L. Wedgwood, C.B., C.M.G., Chief General Manager, and Mr. S. A. Parnwell, Divisional General Manager, Southern Area; Mr. C. L. Edwards, Chief Accountant; Mr. H. N. Gresley, Chief Mechanical Engineer; Mr. G. F. Thurston, Joint Secretary; Mr. W. Clow, Superintendent, Southern Area; Colonel H. H. Mauldin, Chief Assistant Superintendent, G.E. Section, Southern Area; Mr. J. Miller, Chief Civil Engineer, G.E. Section; Mr. A. Oldham, Assistant to General Manager; Mr. A. L.



RAILWAY WAGON FOR TRAIN FERRY TRAFFIC.

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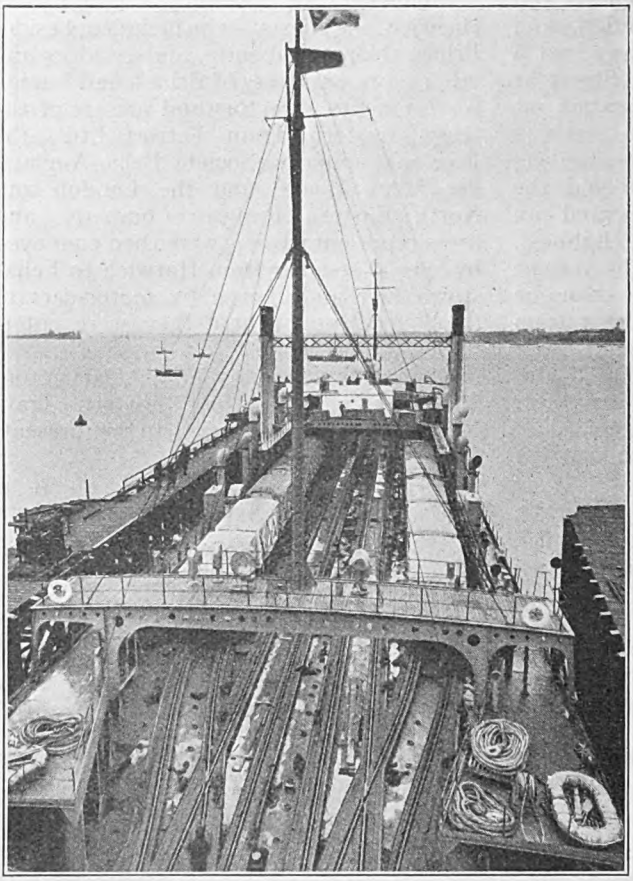

ANOTHER VIEW OF WAGON DECK OF TRAIN FERRY STEAMER.

Gibson, Continental Traffic Manager (South); Mr. L. Sydney Smith, Hotels Superintendent (G.C. and G.E. Sections); Mr. F. Goodricke, Assistant Advertising Manager; Mr. S. T. Burgoyne, Development Agent; Major A. C. Chauncy, Chief of Police, Eastern Section, Southern Area.

Other guests included :—

Colonel A. J. Barry, Consulting Engineer to Great Eastern Train Ferries Ltd.; Sir Davison Dalziel, Bart., Chairman of the Cie. Internationale des Wagons-Lits, and of the Pullman Car Co. Ltd.; Mr. F. A. Brant, Continental Traffic Assistant, Southern Railway; M. P. Defrance, London Representative, Belgian State Railways; Mr. H. Harper, Soc. Anon. John Cockerill; Sir Philip Nash, Chairman, Metropolitan-Vickers Electrical Co. Ltd.; Sir Edward Packard, Chairman, Harwich Harbour Conservancy Board; Sir F. Carne Rasch, Bart., High Sheriff of Essex; Rear-Admiral A. Bellini, representing the Minister of Finance, Italy.

Sir Cyril K. Butler, K.B.E., J.P., presided at the luncheon at the Felix Hotel.

Prince George, in proposing the toast of "The Train Ferry Service," said :—"I thank you all for your reception of the toast of 'The Royal Family,' and Sir Cyril Butler for the kind words in which he proposed it. I assure you I most deeply appreciate it, as I do also the welcome which has been extended to me to-day. In proposing success to the ferry service I would like to say how glad I am to have been able to accept the invitation to come down here for the public inauguration of such an interesting and enterprising undertaking as the Anglo-Belgian train-ferry system. Although the train ferry is not entirely a novelty, having worked successfully both in the Baltic and on the American Great Lakes, and was, indeed, of great service to our country during the late war in a cross-Channel service, yet this marks a new departure in the carrying trade of Great Britain. I am sure we all realise the importance at this time of opening up new avenues of trade. The utility of this service in obviating transhipment with its consequent cost and delay, and establishing through rail communication between this country and most parts of Europe, should create a considerable amount of new trade and traffic between Great Britain and the Continent. Harwich seems to be almost an ideal selection as the ferry terminal for the English portion of the service, as it is so central for the traffic from London, the Midlands and the North, and the harbour is extremely suitable. I trust it will bring an increase of prosperity to this ancient port, which served the Navy so well as a base during the war. It is most gratifying to know that the continental terminal port lies in a country for which we bear such warm and friendly feelings, and I understand that Prince Leopold of Belgium is performing a similar ceremony to-morrow at Zeebrugge. I am sure you

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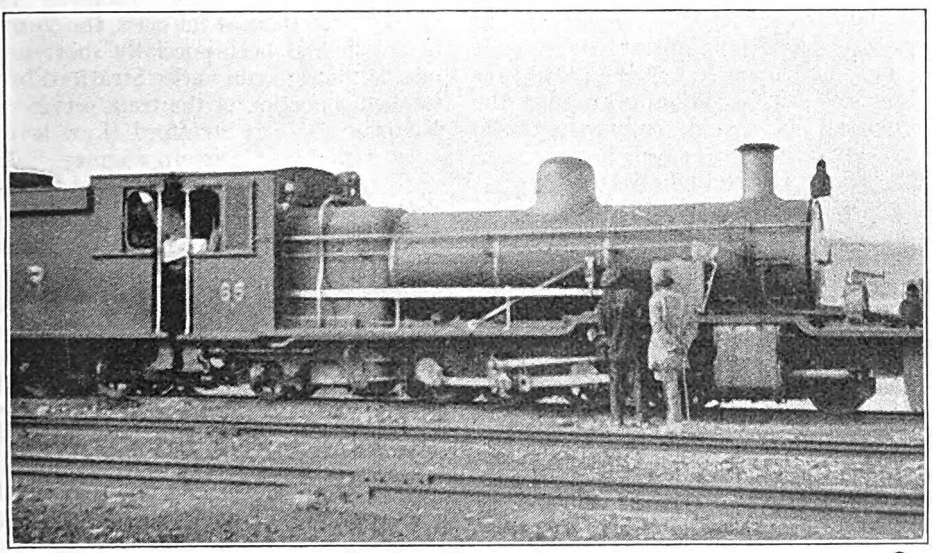
will all hope, as I do, that this will be yet another link in the near friendship of the two countries."

Other speakers were Baron Moncheur, Belgian Ambassador; Mr. Harry Gosling, Minister of Transport; Sir Cyril Butler and Sir Hugh Bell. The latter replying on behalf of the London and North Eastern Railway, said it had indeed been a matter of long consideration to bring the train ferry to the satisfactory issue which had now been reached. He hoped they might regard it as the beginning of a long career of satisfactory usefulness to the world. It had been pointed out that the ferry was looking to the Continent of Europe, and he could say without any exaggeration that the railway company, on whose behalf he was speaking, had always had its face turned to the East. The Continent of Europe was the source from which we drew a very important portion of our traffic, and, therefore, they welcomed the more readily an undertaking which was likely to still further employ our energies in that direction.

CHRISTMAS DAY IN INDIA.



In response to the suggestion made some time ago that readers should send us photographs taken on Christmas Day in various parts of the Empire, Mr. C. C. Barrett, writing from Dera Ishmail Khan, North-West Frontier Province, India, sends a photograph taken last Christmas Day at Kheigi, Waziristan. The engine is one belonging to the Kalabagh-Bannu Railway, a branch of the North-Western State system. It is a 2-ft. 6-in. gauge line running from Kalabagh, on one side of the River Indus, to Bannu and Tank. For military purposes in 1919-20 the line was extended from Tank to Kheigi, the latter place being railhead. There are three up-and-down mixed goods trains daily. They consist of 11 wagons, to which is attached a composite brake, usually part of an armed train, in which a military guard of about twelve soldiers is placed, to prevent stores, &c., being removed by the Mahsuds. No trains run on this section, Tank-Kheigi, after dark. Between Tank, Bannu and Kalabagh military guards are not required, except on ammunition, the country being more peaceable.

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Locomotive and Train Working in the latter part of the 19th Century.

THE NORTH LONDON RAILWAY. [No. 1.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

THE North London Railway started life as a sort of handmaiden of the London and North Western Railway, and has been more or less one of that family ever since. For many years the handmaid preserved an appearance of interesting independence, but of late years the bonds have been drawn so very tightly that it is extremely difficult to say where the family ends and the handmaiden begins. Apparently at present she does not appear to begin at all, and as a result of the Railways Act of 1921, it would appear that the handmaiden has been "transported" to that bourne where governments cease from troubling and railways are at rest.*

The North London began operations as the "East and West India Docks and Birmingham Junction Railway," a title sufficiently suggestive of London and Birmingham—that is, London and North Western—influence. The line was opened in sections between a junction at Bow with the London and Blackwall Extension Railway (now Great Eastern Railway) and Chalk Farm Junction with the London and North Western at various times during the years 1850 and 1851, and the later extension from Bow to Poplar came into operation in 1852. There was no Broad Street station, and for about 13 years the old line from Poplar to Chalk Farm comprised the whole of the North London Railway, to which title the name of the company was changed in 1853.

From the time of the opening until the early part of 1854 the London and North Western provided the locomotive power for all trains, for which purpose a number of old Bury engines, amongst other old London and Birmingham derelict specimens, were used.

The first North London locomotives, Nos. 1 to 10, came from the works of Messrs. Stothert & Slaughter, of Bristol, in 1853–54, and were 2-4-0 well-tank engines with outside cylinders 15 by 22 in. and 5-ft. coupled wheels. In later years, after the Hampstead Junction extension from Camden Town had been opened, some of these engines worked the trains over that section from Camden Town. One or two others of the class, the chimneys of which had been specially shortened to enable them to run under Stratford bridge, worked a portion of the train service from Victoria Park to Stratford (Low level) in turn with Great Eastern engines.

In 1855 no less than three new types of tank engine were introduced on the North London, each of which was not only entirely different from the others, but also from the previously described engines Nos. 1 to 10. There was no idea of standardisation of the locomotives at this period; rather was it a case of sampling almost every known and hitherto unknown form of tank engine which might suitably lend itself to local traffic.

The first of these consisted of three engines, Nos. 12 to 14, of the 0-4-2 type with inside cylinders 14½ by 22 in. and coupled wheels 4 ft. in diameter. The saddle tanks were of rectangular box-shaped pattern, and all the engines had an auxiliary steam pump placed on the platform on the left-hand side. These engines, which were built by Sharp, Stewart & Co., were probably intended for goods traffic, judging from the small size of the coupled wheels, but after 1865 were working a shuttle service between Fenchurch Street and Bow.

The next type, Nos. 16 to 20, also built by Sharp, Stewart & Co., were 2-4-0 side-tank engines with inside cylinders and double frames. The coupled wheels were 5 ft. 3 in. in diameter, and the cylinders

* This article was written before the actual amalgamation was effected.

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were 15 by 22 in. They were very pretty little engines with polished brass domes placed just behind the chimneys. They also had a round sand-box placed upon the top of the boiler barrel, which, I think, must have been added by Mr. Adams.

Following these came Nos. 21 to 25 from R. Stephenson & Co., of the 4-4-0 side-tank type with leading bogies. The bogies, like all those of the earlier North London engines, had outside frames, and were of the swivelling pattern without lateral play for the bogie-pins. The cylinders were inside, 15 by 22 in., and the coupled wheels were 5 ft. 3 in. in diameter. One of these engines ultimately came into the possession of the Clifton Colliery, Nottingham, and for many years—until quite recently, in fact—shunted the colliery yard on the banks of the Trent, and worked the branch connecting the sidings with the Midland line between Nottingham and Beeston.

Another series of somewhat similar 4-4-0 side-tank engines, with inside cylinders 16 by 22 in. and 5 ft. 3 in. wheels, came from the works of Stothert, Slaughter & Co. in 1860–61. These were Nos. 30 to 37. After 15 to 20 years' service several of these were sold. No. 35 went to the Isle of Wight Central Railway, and three others migrated to Scotland, where they worked the passenger-train service on the Girvan and Portpatrick (later the Ayrshire and Wigtonshire) railway.

Still another type of engine was introduced in 1860. This consisted of five 0-4-2 saddle-tank engines, Nos. 38 to 42, built by Beyer, Peacock & Co., with inside cylinders 16 by 24 in. and 5-ft. coupled wheels. The trailing wheels, 3 ft. 6 in. diam., had outside bearings. The saddle tanks had rounded tops and were of large size, extending from the front of the smoke-box to the extreme back of the firebox and, probably owing to their height, no weather-boards were provided for the protection of the men on the foot-plate. These engines, like the majority of the early North London engines, had polished brass domes.

There were two other nondescript passenger engines, of which one—No. 15—was an old Bury four-wheeled single engine with haystack firebox, and had been originally built for the London and Birmingham Railway by Rothwell & Co. in 1837. This engine had 5 ft. 9 in. wheels and 13 by 18 in. cylinders. When the

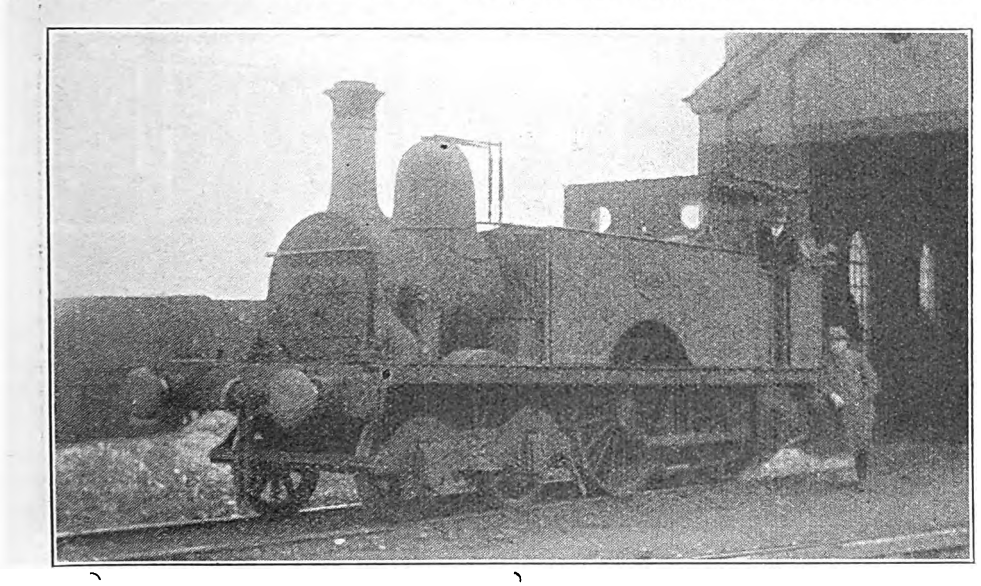

Photo.] [*Loco. Publishing Co. Ltd.*

OLD NORTH LONDON 4-4-0 TANK ENGINE (1855-1861 PERIOD) AT CLIFTON COLLIERY, NOTTINGHAM.

Coupled wheels 5 ft. 3 in. diam. Cylinders 15 in. by 22 in.

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London and North Western had got all they could out of this old-stager they thoughtfully disposed of it to the North London. It was rebuilt at Bow as a six-wheeled "single" tank engine with the addition of a pair of trailing wheels behind the firebox.

Of the other engine, No. 27, the writer knows very little. It was a 2-4-0 tender engine subsequently converted to a saddle-tank engine.

In 1863 Mr. William Adams, the chief locomotive engineer, began the construction of engines at Bow Works, and since that time the whole of the North London engines have been built there. The type then adopted was a 4-4-0 side tank with inside cylinders, and the leading bogies had outside frames, as in the case of the 21 and 30 classes. The first engines to be built were Nos. 43 to 50, which came out in 1863 to 1865. They had 5 ft. 3 in. coupled wheels, 16½ by 24-in. cylinders, and a total heating surface of 895½ sq. ft. Perhaps their most remarkable characteristic was that they carried a boiler pressure of 160 lb. per square inch at a period when the best engines of most railways, including those of the London and North Western Crewe-built engines, were working at a pressure of 120 lb. The engines were of very handsome appearance, with neat copper-topped chimneys, polished brass domes on the second ring of the boiler barrel, and polished brass Ramsbottom valves over the fireboxes. The sand-boxes were placed on the boiler in front of the dome.

These were succeeded by a larger class of the same type, Nos. 51 to 66 and 11 to 18, built at Bow during 1865 to 1869. The coupled wheels of these had a diameter of 5 ft. 9 in. and the cylinders were 17 by 24 in. The driving wheels with new tyres were during later years increased to 5 ft. 11 in. diam. The bogies were of the same outside framed pattern, but their wheelbase of 6 ft. was considerably longer than that of the previous engines. The engines carried the same high pressure of 160 lb. and the total heating surface was 958 sq. ft., towards which a large firebox contributed 112 sq. ft.

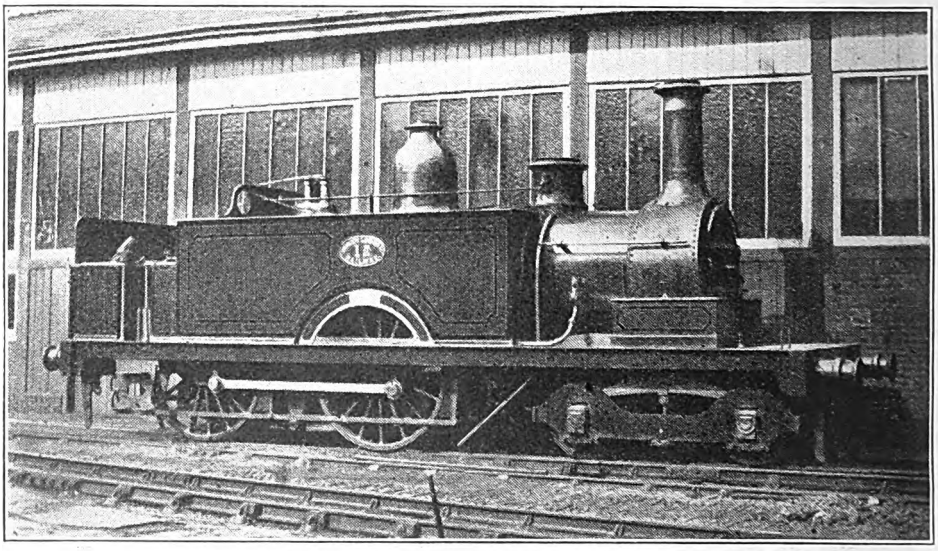

Photo.] [*Loco. Publishing Co. Ltd.*

INSIDE CYLINDER 4-4-0 TANK ENGINE No. 12.
Period 1865–8. Designed by Mr. W. Adams.
Coupled wheels 5 ft. 9 in. diam. Cylinders 17 in. by 24 in.

Having given some idea of the many types of passenger engines then in use, something may now be said of the old train working. Prior to 1865 the inhabitants of Islington and Canonbury, who

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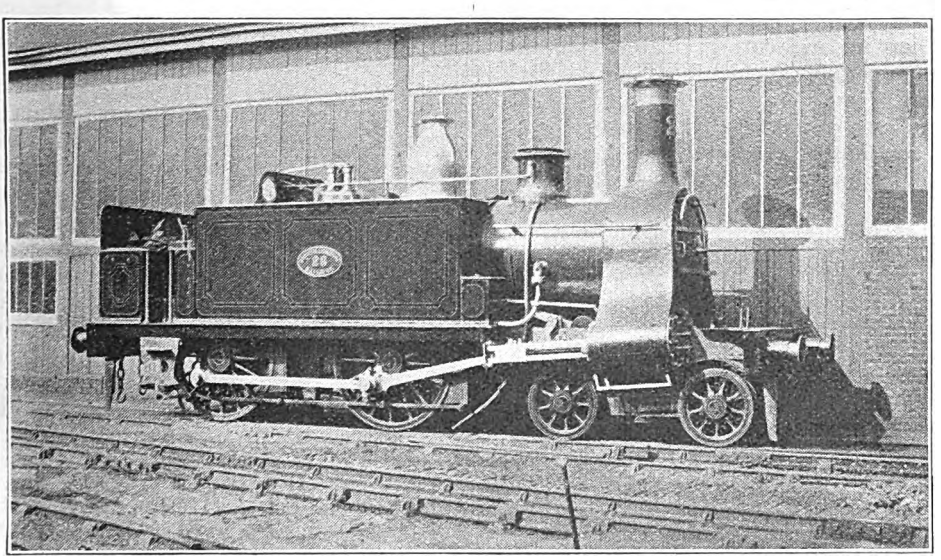
used the North London line for their journeys to and from the City, had to travel by a through service of trains, which took the circuitous route via the old line north of the present Dalston Junction station, and Bow to Fenchurch Street. This was after the manner of a journey from Dan to Beersheba, and was therefore all very well for those whose business lay at the Aldgate end, but was not otherwise convenient. At Fenchurch Street the North London had the exclusive use of one platform, from which there was a 15-minute service during the busy hours.

1 to 10 appear to have been used principally between Camden Town and Richmond, but were rarely, if ever, to be seen at Fenchurch Street. The same engines which ran to the City also worked to Poplar.

Broad Street station was opened in 1865, together with the direct line from Dalston Junction—which station, by the way, is of a later date. From this time the City service of the North London from stations west of Dalston became what it now is, and a new service sprang up between Broad Street and Poplar.



4-4-0 OUTSIDE CYLINDER TANK ENGINE No. 28.
Period 1868–1876. Coupled wheels 5 ft. 6 in. diam. Cylinders 17 in. by 24 in.

Thence the trains looped a sort of loop round the east end and north of London and eventually reached Camden Town, where some of them were divided. The main-line portion went to Chalk Farm, and another engine took the rear portion on to Richmond over the Hampstead Junction line, which had been opened in 1860.

The engines which ran to Fenchurch Street in those days were the 2-4-0 tanks 16 to 20, and the 4-4-0 tanks 21 to 25 and 30 to 37, with occasional visits of the 0-4-2 tanks 38 to 42. The older engines

Fenchurch Street still remained as an outlying point to which North London trains ran, being served by a shuttle service to and from Bow, worked by the small 0-4-2 saddle tanks Nos. 12 to 14. This service lasted until the end of December, 1868, when it was withdrawn, and since then Fenchurch Street has been a dream of the past as far as the North London is concerned. Whether Fenchurch Street station ought to be described as a "dream" I leave for those readers who use it to answer.

(*To be continued.*)

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Railway Exhibits at the British Empire Exhibition.

FIVE stands have been equipped by British railway companies, together with a sixth jointly provided by the Great Southern and Western and Midland Great Western Railways of Ireland. These stands, together with that of the Westinghouse and Saxby Signal Company, are all located together in one corner of the building. This corner is, incidentally, one which, judging from the numbers of visitors, proves an exceptionally popular one—due, no doubt, to the fact that several actual locomotives and vehicles are there exhibited, indicating the widespread interest taken in locomotives and railways by people of all ages and classes.

Southern Railway.

The special feature of the Southern Railway exhibit is the series of scenic models of places of holiday interest served by the system. These are arranged angularly in alcoves, and give realistic impressions of Margate, Bournemouth, Eastbourne, Brighton, Worthing, Southsea and the Channel Islands, assisted by photographs in colour. Elsewhere on the stand are to be seen models of steamships—*Maid of Orleans* and the *Queen* on the Dover-Calais and Folkestone-Boulogne Continental services, and the *Lorina* running between Southampton and the Channel Islands. Attracting even more interest are very fine models of Southampton Docks and of the new floating dock recently delivered by Armstrong, Whitworth & Co. Ltd. to the Southern Railway Company for use at Southampton. At the end of the stand is a large picture showing "The Tree of Health," the routes of which are drawn to fit a map of the Southern Railway system, while the "fruit" is indicated by circular colour photographs of various holiday and recuperative centres to which the Southern Railway gives access. A small cinema hall is also provided for the display of films relating to places of interest served, and illustrating various activities of the Southern Railway.

London Midland and Scottish Railway.

On this stand the *pièce de résistance* is a new third-class carriage, fitted with tables, and, therefore, designed to be used with a kitchen car for restaurant purposes. It stands on standard L.M.S. permanent way, and stairways are erected so that visitors can pass through the car. Further attention is directed to the permanent way by a full-sized section of chair, rail and fastenings. In glass cases are shown models of the ss. *Anglia* (used for Holyhead services) and *Duke of Cumberland* (Fleetwood-Belfast services); also models of the royal saloon and of the locomotive *Sir Gilbert Claughton* (repainted and numbered in the new style), brought to Wembley from the Great Hall at Euston. Uniformed attendants are well supplied with tourist and travel literature, &c.

Metropolitan Railway.

Here a third-class trailer coach of the latest type is shown. Stairways enable visitors to pass inside. An outstanding feature of the exhibit is a pictorial map covering the whole of the district served by the Metropolitan lines. Colours and signs are used to indicate the various lines, golf courses, and housing estates served by the Metropolitan and Metropolitan and L.N.E. joint lines from town right out to Verney Junction and Brill. Another stand carries a model of a representative residence as provided on some of the estates in which the Metropolitan Railway is interested. Glass-case models of a "Planet" type locomotive and of "Trevithick's" engine may also be noted. There are also two-position upper-quadrant and colour light signals, a fog repeater and illuminated diagram as in use at Wembley Park station, together with items arranged in conjunction with the Westinghouse Brake and Saxby Signal Company, whose stand is immediately opposite.

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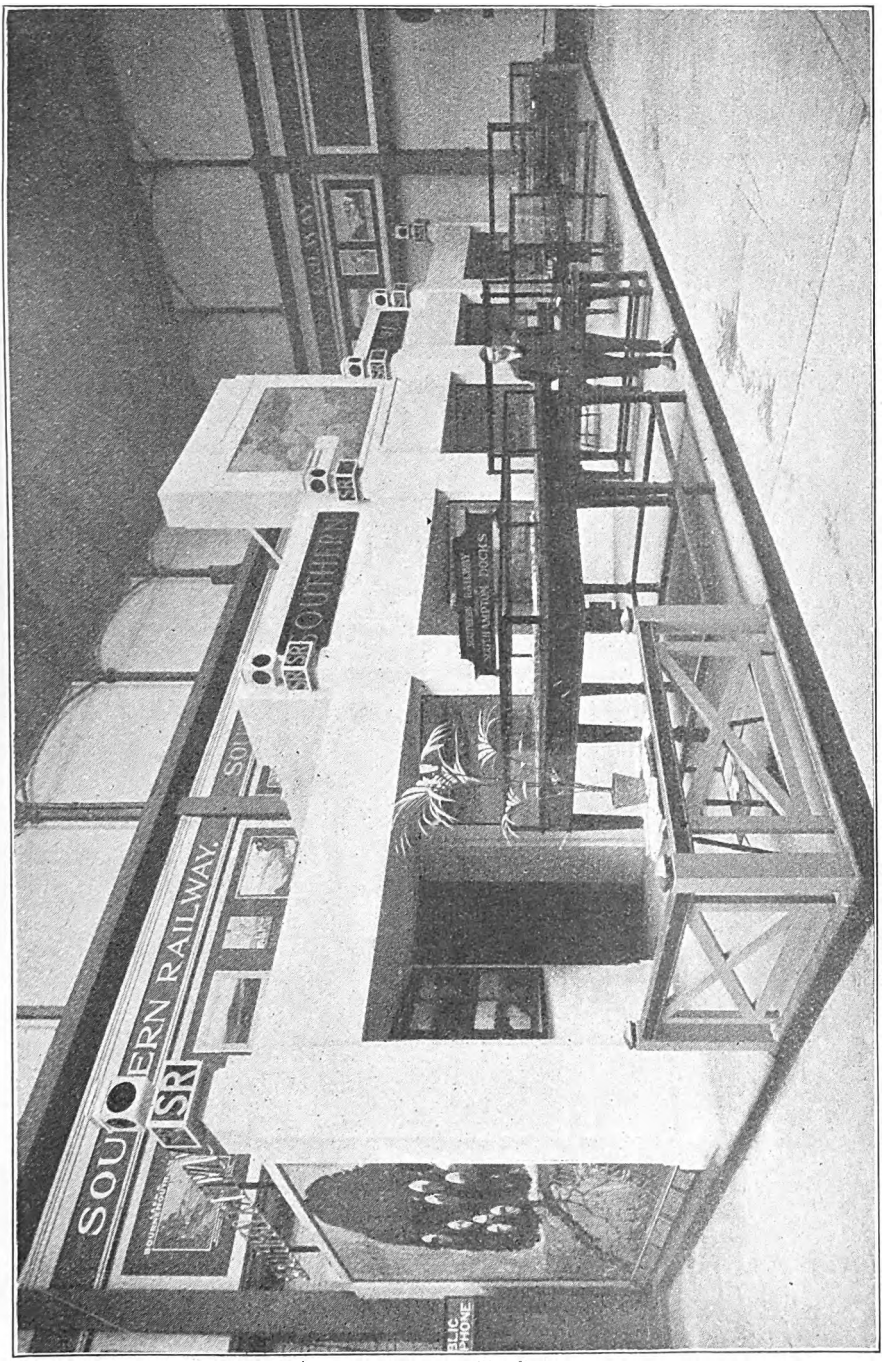

Photo.] SOUTHERN RAILWAY. [*Campbell Gray.*

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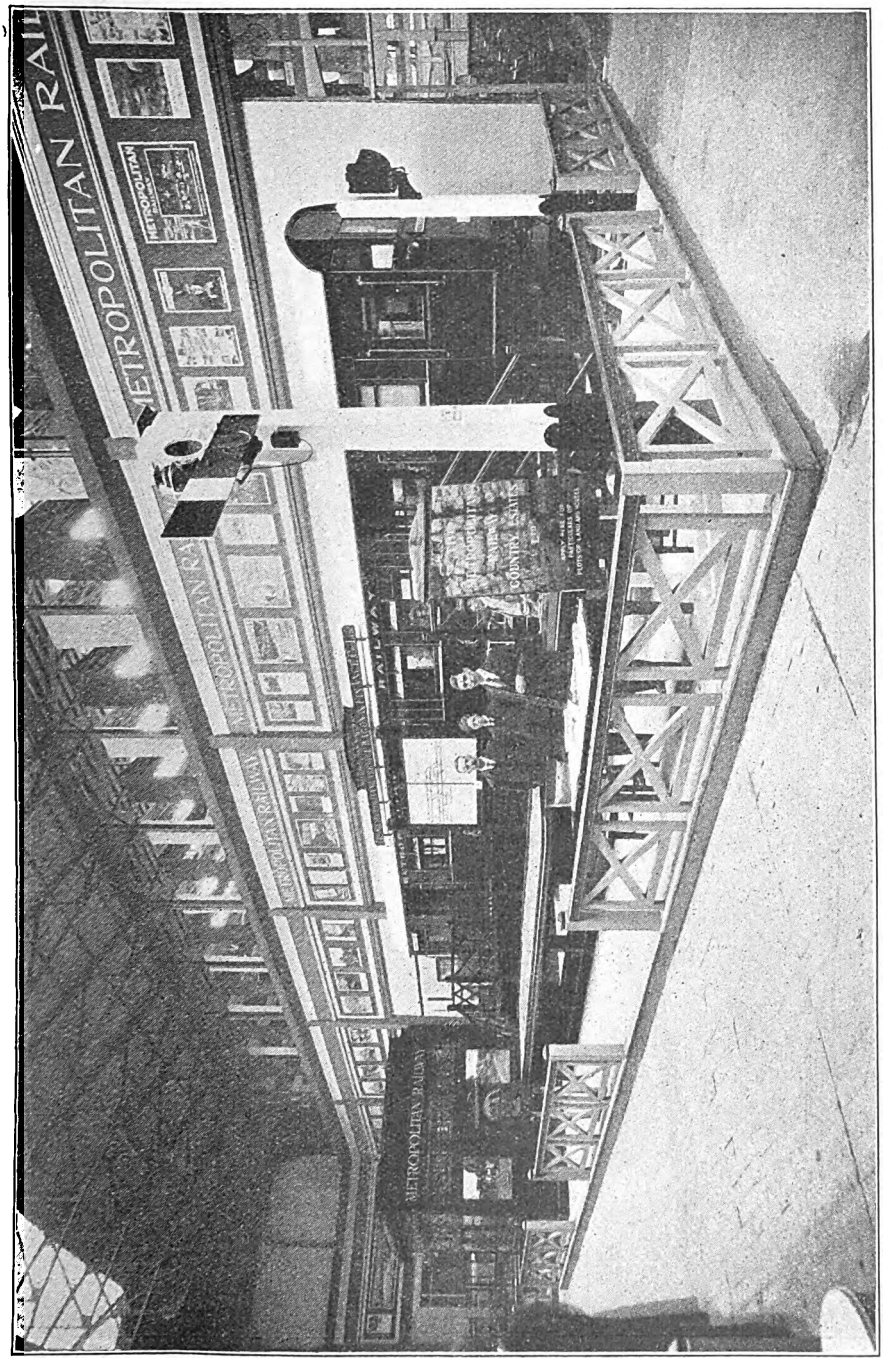

[Photo.] METROPOLITAN RAILWAY. [Campbell Gray.

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GREAT WESTERN RAILWAY.

The outstanding feature of this stand is the fact that the first engine of the "Castle" class, *Caerphilly Castle*, is exhibited. Placed about the stand are large models of Bute, Barry and Newport Docks, indicating their respective features and the equipment provided. At each end of the exhibit are stands, including a relief map of the area served by the Great Western Railway. The photographs on these two stands, and on others placed intermediately, include scenic views, photographs of the Fishguard and Tregenna Castle (St. Ives) Hotels, views taken in Paddington and Newtown (Cardiff) goods stations, and showing various activities on the railway or indicating how the company has at various times conveyed exceptional loads. A model is also exhibited of a heavy gun carried on a 30-ton girder wagon.

LONDON & NORTH EASTERN RAILWAY.

Here the most striking characteristic is the comparison in dimensions, capabilities, construction and finish afforded by the juxtaposition of George Stephenson's famous engine *Locomotion No. 1*, which was used for the opening on September 27, 1825, of the Stockton and Darlington Railway, the first public railway in the world on which steam locomotives were used, and one of Mr. H. N. Gresley's latest "Pacific" locomotives, No. 4472, *Flying Scotsman*. To complete the comparison the original tender is attached to Stephenson's old engine, and behind, suspended from the end of a projecting bar, is a fire bucket (illuminated electrically to give the impression of an actual fire) which apparently did duty as head light or tail light or both in those early days. Accompanying is an early signal. Alongside No. 4472 is a modern signal post carrying "stop" and "distant" arms, the latter painted yellow and having amber and green spectacles in accordance with latest methods. Attached to the post of the old signal is a case showing rail sections as used on the Stockton & Darlington Railway in 1830, and on that section of the North Eastern Railway during the twentieth century.

So far as other firms are concerned, it may be mentioned that the North British Locomotive Company show the Reid-MacLeod turbine locomotive illustrated and described in the May number, also models of a modern Egyptian State 4-6-0 locomotive, a New South Wales 2-8-0 engine, and a French 4-6-2 locomotive. Models have also been added showing a modified "Fairlie" locomotive of a new type now being introduced, and an electric locomotive for the Japanese Government Railways, of which the mechanical parts were built by the North British Locomotive Company, and the electrical equipment added by the English Electric Co. Ltd. Two stands are occupied by Armstrong, Whitworth & Co. Ltd. On one of them is a 4-8-0 three-cylinder oil-burning locomotive built to the order of the Buenos Ayres Great Southern Railway. Among the various models shown on one or other of this firm's stands may be mentioned one of a Belgian 2-8-0 locomotive. Messrs. Beardmore & Co. show a new L.M.S. 4-6-0 locomotive of the "Prince of Wales" class fitted with Mr. H. P. M. Beames' arrangement of outside Walschaert valve gear to operate inside valves.

Standing immediately adjacent to the stand of the North British Locomotive Co. Ltd. is a neat octagonal pavilion around which are displayed the various publications, railway and otherwise, issued from 33, Tothill Streeet, Westminster. These include the *Railway Gazette* and *Shipbuilding and Shipping Record* (weekly), *Railway Engineer*, *Railway Magazine*, *Power Engineer*, *Colliery Engineer*, and *Marine Engineer* (monthly), and *The Universal Directory of Railway Officials*, *The Directory of Shipowners*, *Shipbuilders and Marine Engineers*, and *The Railway Year Book* (annuals). Various books, pamphlets, &c., are also shown.

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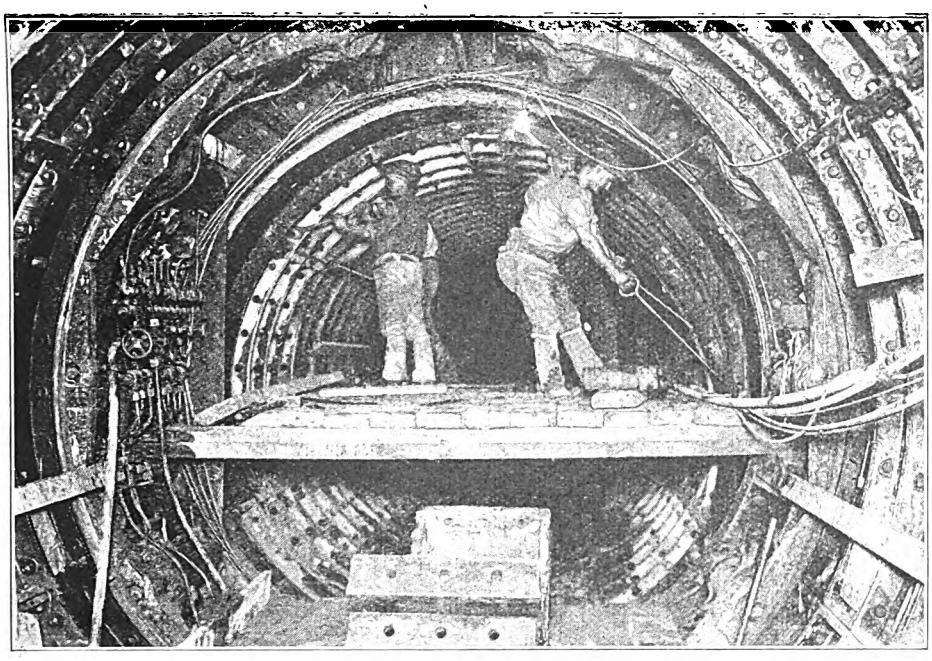

TUBE ENLARGEMENT AND SHIELD.

Reconstruction of the City and South London Railway.

ALTHOUGH the City and South London Railway was not quite the first "tube" to be constructed, having been preceded by a passenger footway subway under the River Thames near the Tower, it was the first railway to be built on this system, not only in London but in the world generally. The idea was first mooted by Barlow, and his assistant, James Henry Greathead, engineer to the City and Southwark Subway Company, from which the City and South London developed, introduced the shield method of boring. This system was employed with great success in constructing the line, and is still the standard method for such undertakings, though greatly developed and improved in the light of experience and as more modern appliances have become available.

The City and Southwark Subway Company, as fully described by Mr. H. C. Hopwood in the December, 1910, RAILWAY MAGAZINE, was promoted, and Parliamentary powers obtained for its construction as between the Elephant and Castle and the Monument in 1884. Further powers were obtained in 1887 for an extension to Stockwell, and in 1890 for a further extension from Stockwell to Clapham. The title was then changed to the City and South London Railway. It was at first proposed that the line should be worked by cable traction, as at that period electric traction was in its early stages as applied for railway purposes. Some time before completion, however, electric traction was decided upon, and the line was accordingly designed to be worked by electric locomotives and trailer cars, with a centre current rail and running rail return. The Monument-Stockwell section was formally inaugurated by King Edward VII, when Prince of Wales, in November, 1890, and opened for traffic on December 18, 1890.

Having thus obtained the distinction of being the first underground electric and the first tube railway in the world, its

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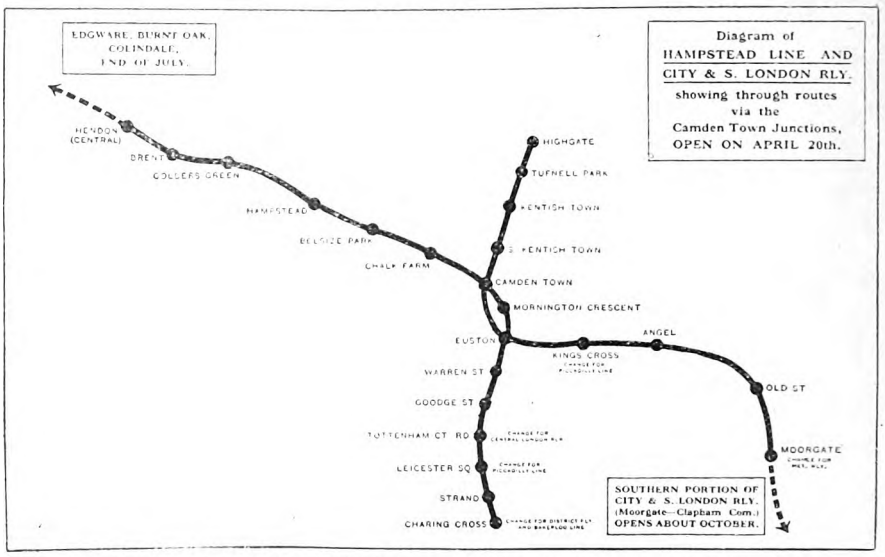

MAP SHOWING CONNECTIONS OF CITY AND SOUTH LONDON AND LONDON ELECTRIC RAILWAYS.

successful operation naturally caused the construction of other tubes in the London area, the first to follow being the Waterloo and City, opened in 1897, the Central London, opened in 1900, coming third. Meanwhile, however, steps had been taken for extending the City and South London line. In February, 1900, the original terminus at the Monument (King William Street) was closed, it having been found necessary to construct new tubes under the river in order to reach the Bank and so continue to Moorgate Street, to which traffic was then inaugurated. In June of the same year the Clapham Common extension was opened; in 1901 the line was extended northwards to the Angel, and in May, 1907, Euston was reached.

The tunnels varied in diameter from 10 ft. 2 in. on the earliest section to 11 ft. 6 in. on the later extensions, and all the stations were of the island type. These, it may be mentioned, are now being made a uniform length of 350 ft., with an average width of 12 ft. The cars were built of a design similar to the old tramway vehicles, and were hauled by electric locomotives, approximately 100 passengers being accommodated in the three-car trains. At first the cars were practically without windows, the idea being that these were unnecessary on a "tube" line, gatemen on the end platforms supplying information as each station was reached. Windows were, however, added before very long.

As the oldest tube railway in the world, the City and South London had many drawbacks, the greatest of which was the inadequacy of its loading gauge to accommodate the larger and more up-to-date rolling-stock of the newer tubes. Thus, although this railway had its terminus at Euston, physical connection between it and the tube railways serving the northern suburbs was impossible in the absence of wholesale widening operations. This was the situation when the City and South London was absorbed in the group associated with the Underground Electric Railways Company of London, Ltd.

No time was lost in taking steps to secure the much-needed connection, but although the necessary Parliamentary powers were obtained in 1913, the incidence of the war prevented a commencement of the work until August, 1922.

The problem was complicated by the fact that junctions already existed just south of Camden Town station between the north and south-bound lines to Hendon and the north and south-bound lines to Highgate. Physical connection had thus to be effected between the City and South London Railway and both these sets of lines, and in view of the density of traffic

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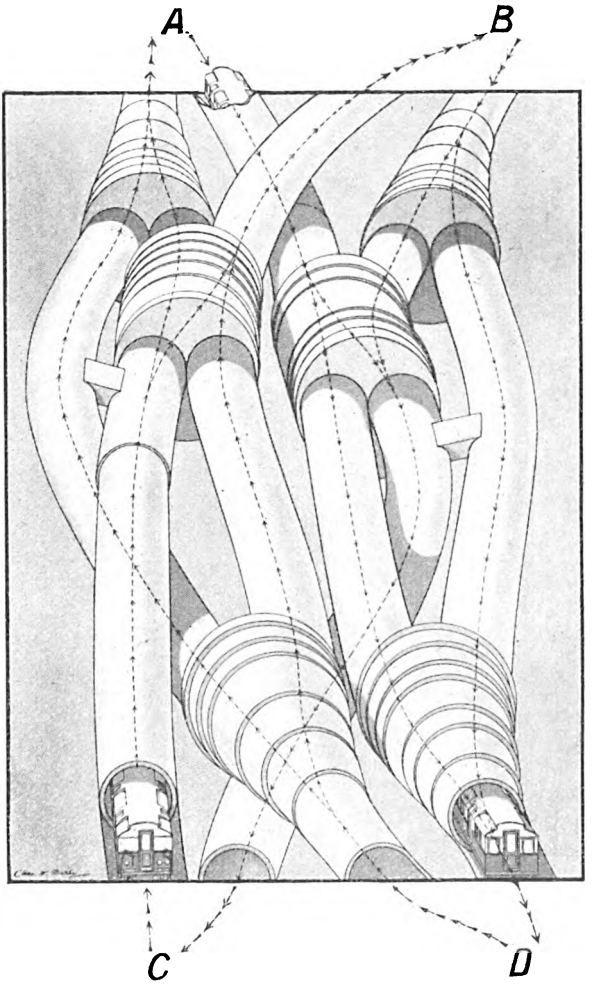
which would result from the new facilities, none of the existing lines could be crossed on the level. Recourse was, therefore, had to flying or burrowing junctions, with the result that the two tube tunnels immediately south of Camden Town have had to be increased to six.

The two tube stations at Euston are situated at right angles to one another, but on different levels. The new railway is, therefore, carried from a point 245 ft. west of Euston station (C. and S.L.R.) platforms in two tubes passing under the Charing Cross, Euston and Hampstead Railway, and thence in a diagonal direction by a curve of approximately 1,050 ft. in length and comprising three transition curves. These have a length of 300, 450 and 300 ft. respectively. The first and third of these curves are made up of 100 ft. each of 20, 15 and 10-chain curves; the second is of 438-ft. radius on the north-bound and of 420-ft. radius on the south-bound route. Thence onwards to the commencement of the six tunnels—a point approximately 1,330 yards from Euston—there are curves varying from 15 to 40-chain radius. On the straight the diameter of the tunnel is the standard one of 11 ft. 8½ in. for medium curves, of from 20 to 10 chains the diameter is 12 ft., and for severe curves of 10 chains or less it is 12 ft. 6 in. Where all lines converge or diverge the tunnel is stepped up to 25 ft.

The whole of the work was carried on through the medium of three shafts. Two of these were sunk at Mornington Crescent station—a distance of 3,180 ft. from Euston—between the existing tunnels and the Hampstead Tube. One of the shafts, sunk to a depth of 60 ft., was used for the building of the north-bound tunnel and the other, carried to a depth of 80 ft., for the south-bound tunnel. From each of them it was necessary to drive an 8-ft. heading to gain access to the route of the new lines. Having reached the desired location, two shield chambers of 15-ft. diameter were built for each tube, and in these the "Greathead" shields were erected, tunnelling being proceeded with in either direction. The third shaft was sunk to a depth of 89 ft. in Ampthill Square, 1,500 ft. from Euston; as at this point both tubes are on the same level a single shaft sufficed. The most intricate work was performed at the junctions at the Camden Town end, where operations were confined to a period of four or five hours each night



REPRODUCTION OF PART OF POSTER, SHOWING ARRANGEMENT OF TUBES AT CAMDEN TOWN.

A—To and from—Camden Town, Chalk Farm, Belsize Park, Hampstead, Golder's Green, Brent, Hendon (Central), Colindale, Burnt Oak and Edgware.

B—To and from—Camden Town, South Kentish Town, Kentish Town, Tufnell Park and Highgate.

C—To and from—Euston (C. & S.L.R.), King's Cross, Angel, Old Street and Moorgate.

D—To and from—Euston (L.E.R.), Warren Street, Goodge Street, Tottenham Court Road, Leicester Square, Strand and Charing Cross.

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during the suspension of traffic on the Charing Cross, Euston & Hampstead Railway.

The total length of the extension from Euston to Camden Town is 5,000 ft. The stiffest gradient against the traffic is 1 in 40 on the north-bound line, whilst with the traffic the heaviest incline is 1 in 30 on the south-bound line. Approximately 80,000 tons of spoil were removed during the operations, and 13,000 tons of segments were fixed. Six "Greathead" shields were employed on the whole of the work, which has occupied a period of only 17 months. It is interesting to note also that with such extraordinary precision was this intricate tunnelling carried out that the margin of error in calculating the tunnel alignment was nowhere greater than $\frac{1}{4}$ in. No fewer than 17 connections have been made between new and existing tunnels without impeding in any way the normal daily traffic of the Hampstead line.

Each of the six lines south of Camden Town station has its separate tube. Trains from Charing Cross for Hendon pass to the left at facing points 19 (see diagram on p. 481) and enter a tube which passes under that from Clapham Common. The line from Highgate to Charing Cross, instead of joining the line from Hendon near the box, enters a new tube and joins the Hendon line near to Mornington Crescent. The latter line remains practically unaltered; it passes under the line to Highgate as before. The line from Highgate to Clapham Common has a connection on the level with the line from Hendon and lies in a new tube that passes under the lines to and from Charing Cross. The whole is an excellent example of flying junctions and displays considerable skill in its design.

The signalling itself needs no explanation as all its details are shown on p. 481. Every signal is controlled by track circuit and provided with an automatic stop. All points and fouling connections are track-locked. The track circuits are as short as possible so as to allow for the quick clearance of the signals and a close train headway. An illuminated diagram shows the state of all the lines and the signals controlled from the box as the signalman sees none of these.

The signal frame at Camden Town is the largest of its type in the British Isles, and is remarkable in that, to all intents and purposes, the signalmen have no sight of any of the trains whose movements they are controlling. One cabin, on the north-bound platform (Highgate line), controls all the junctions for every route, both north and south. The plant was supplied by the Westinghouse Brake & Saxby Signal Co. Ltd., but installed by the "Underground" signal staff under Mr. W. S. Every.

The signalling is all-electric. The frame includes 43 levers, 37 of which are operative. The illuminated diagram indicates to the signalmen the condition of the lines within their jurisdiction. Separate indicators warn them of the destination of each train approaching the station, and enable them to give the required path. Each of the respective tunnels is in telephonic communication with the signal-box, so that in the event of emergency drivers can get into touch, not only with the signalmen, but, by means of circuit switches, with any of the officials or stations on the "Underground." There is also a permanent power frame, with illuminated diagram, at Euston, while at several other stations where there are crossovers necessary frames are installed.

The plans for the extensions were prepared by, and the work has been carried out under the supervision of, Mr. H. H. Dalrymple Hay, consulting engineer to the Underground Electric Railways Company of London Ltd., the contractors being John Mowlem & Co. Ltd., of Ebury Bridge Road, S.W. 1. The laying of the permanent way, conductor rails, cables and signals was carried out by the company's own staff.

Passenger cars of a novel type, and providing a much greater degree of comfort than their predecessors, are now used for the through services over the City & South London and Charing Cross, Euston & Hampstead Railways. A number of these vehicles have already been placed in traffic. The entire order entails an expenditure of £710,000, and comprises 81 motor-cars, 35 control trailer cars, and 75 ordinary trailer cars. The work has been distributed between Cammell Laird & Co. Ltd., of Nottingham; the Metropolitan Carriage, Wagon & Finance Co. Ltd., of Birmingham; and the Birmingham Railway Carriage & Wagon Co. Ltd.,

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of Smethwick. Constructed to the specifications of the London Electric Railway, the coaches embody the principal features of the six experimental cars built during 1922, at the company's expense, by different rolling-stock manufacturers, with a view to arriving at the ideal car for electric railway service. The overall length of each car is 49 ft. 9¼ in., width 8 ft. 6¾ in., and height (overall) from the running rail 9 ft. 6 in. The motor cars will seat 30 passengers, and the control trailers 44, and the ordinary trailers 48. The unladen weight of the motor cars is 31 tons and of the trailer cars 17 tons 15 cwt.

It should be emphasised that the undertaking is merely a part, albeit a vital one, of a far-reaching scheme which will provide a through tube railway from Edgware in the north to Morden in the south, a distance of 25 miles. The work of enlarging the existing tunnels of the City & South London Railway enables them to accommodate the standard Underground rolling-stock, and the opening of the line to Moorgate, with considerably improved station accommodation there and at Euston, King's Cross, Angel and Old Street, marks the first step in this great project. The next will lie in the resumption of the service to and from Clapham Common, which, it is anticipated, will take place in a few months, whilst the extension of the Hendon line northwards to Edgware is now rapidly approaching completion. The third development will take place on the accomplishment of the southerly extension from Clapham Common to Morden. The final undertaking, so far as works at present authorised are concerned, will be the extension of the Charing Cross, Euston & Hampstead Railway from its present terminus at Charing Cross to Kennington, where it will connect with the City & South London Railway.

In the meantime, by the opening of the Camden Town link, passengers from the northern suburbs, including Hendon, Golder's Green and Highgate, will have direct access to the heart of the City and will no longer have to suffer the inconvenience of changing at Euston or Tottenham Court Road. Journey times which prevail under the new arrangements include (to Moorgate) from Hendon, 26 min.; Golder's Green, 21 min.;

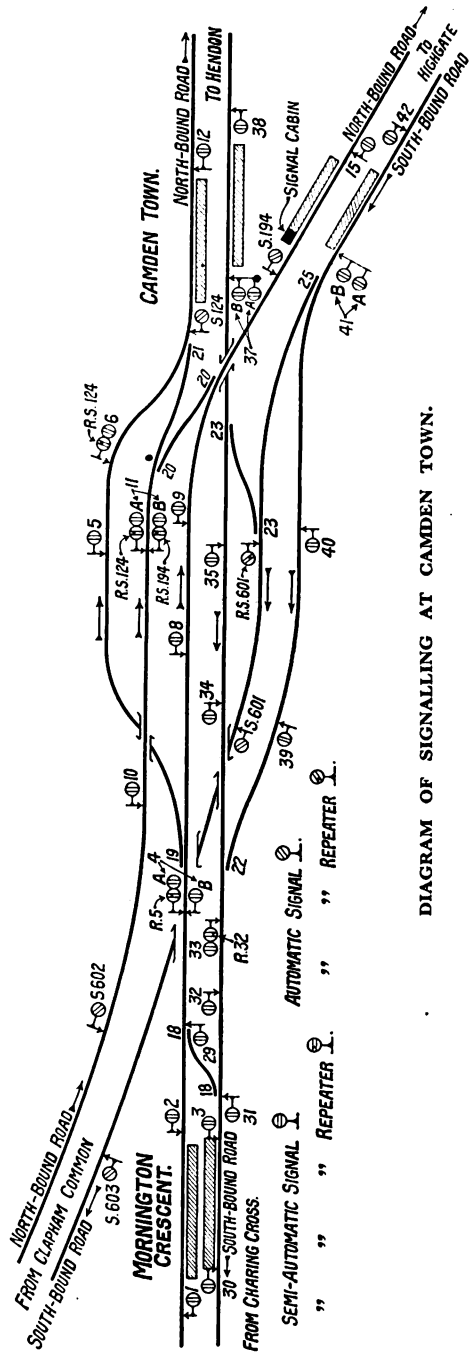

DIAGRAM OF SIGNALLING AT CAMDEN TOWN.

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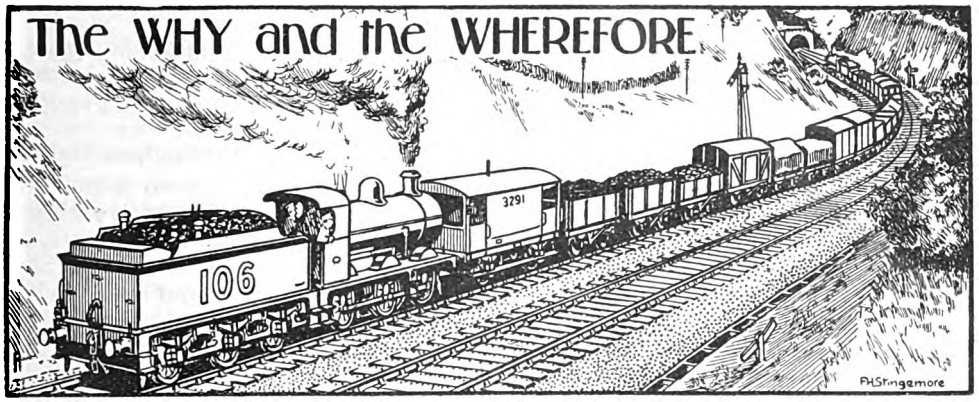

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Applications for information concerning "British Locomotive Practice and Performance" may be addressed to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, *33, Tothill Street, Westminster, London, S.W.1. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history or "grouping," the pages of the "Railway Year Book" (5s. net) should be consulted. The twenty-seventh Annual Edition* (1924) *of this standard railway reference work is now at press. All previous Editions are out of print.*

Locomotive Shed Indications, Southern Railway,

We are advised that the locomotive power classification, as set forth in the May number, is incorrect in certain respects, and therefore give this information again, in a form which embodies particulars since received :—

Class.	Type.
A ..	All "Urie" engines (4-6-0, 4-6-2T and 4-8-0T).
	All 4-6-0 "Drummond" engines except 443/447, 458/462.
B ..	4-6-0 "Drummond," 443/447, 458/462.
C ..	0-6-0 "Drummond."
D ..	4-4-0 large "Drummond" (6 ft. 7 in.).
E ..	4-4-0 large "Drummond" (6 ft. 1 in.).
F ..	4-4-0 small "Drummond" mixed traffic (5 ft. 7 in.).
G ..	0-6-0 "Adams."
H ..	4-4-0 small "Drummond" (6 ft. 7 in.), except 290/299.
I ..	4-4-0 small "Drummond" (6 ft. 7 in.), 290/299.
	4-2-2-0 "Drummond."
	4-4-0 "Adams" (6 ft. 7 in. and 7 ft. 1 in.).
J ..	0-4-2 "Adams."
	0-6-0 "Beattie" (only a few in service still).
K ..	0-4-4T "Drummond."
	0-4-4T "Adams," except 177/236.
	4-4-2T "Adams."
	Older 4-4-0 "Adams."
Unclassed—	
	"Adams" 0-4-4T's 177/236, 0-4-0T's and 0-6-0T's.
	"Beattie" 2-4-0T's.

[Further reply to "TAUNTONIAN" and R. A. HARDY.]

County Donegal Joint Committee's Railway.

We are indebted to Mr. H. Forbes, Secretary of the County Donegal Railway's Joint Committee, for the following information in regard to rolling-stock on this line and on the Donegal Railway. In 1905 the Donegal Railway Company had their engines painted green. The passenger carriages were painted chocolate with cream panels, similar to those of the London and North Western Railway. The goods wagons were coloured red. The present colours were adopted in 1912, as being more serviceable owing to the severe conditions met with along the Atlantic Coast, viz., engines, black with red lines; passenger coaches, black with red lines; goods wagons, black. As all the trains on this line are run as mixed trains, there is therefore a uniformity, the engines, carriages and wagons all being of the same colour.

[Reply to W. R.]

G.W.R. Locomotives.

Practically all 4-4-0 locomotives until the "City" class, apart from a few of the older ones, were designed by Mr. Dean, including the Badminton series, *Earl Cawdor* and the original *Duke of Devonshire* and *Pendennis Castle* mixed-traffic 4-4-0's. Most, if not all, of these engines

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now include the characteristics of Mr. Churchward's practice. No. 111, *The Great Bear*, was practically restricted to running between Bristol and London. When used for other trains the engine was probably changed at Swindon or other division point. The engine is, we understand, now in Swindon Works in course of rebuilding. Illustrations purporting to show the engine on trains such as the "Cornish Riviera" are incorrectly labelled. Copies of pre-war issues of the RAILWAY MAGAZINE are frequently offered in our advertising pages.

[Reply to J. C. DREW.]

L.M.S. (Midland Division) Locomotives.

All the 4-4-0 engines of Mr. S. W. Johnson's design numbered from 700 to 779 inclusive are practically identical in all respects, except that Nos. 700 to 749 have the high-sided tenders and the remainder the low-sided tenders to which you refer. Numbers from 780 to 989 in the Midland list are at present unallocated. Total number of 4-2-2 engines still in service is 84 on this Division, but we have no information as to the number of Kirtley 0-6-0 and 2-4-0 engines still at work. The only engines off the London, Tilbury and Southend section which are at work on the Midland line proper are the large 4-6-4 tanks, Nos. 2100 to 2107 inclusive. The Westinghouse brake is still in use on passenger trains on the L.T.S. Section.

[Reply to L. B. S., W. T. THORNEWELL and "CANADIAN PACIFIC."]

Harwich-Glasgow Through Service, L. & N.E.R.

In the forward direction this coach is worked to Sheffield on the Liverpool boat express, as heretofore, and thence to York and Glasgow by the 2 p.m. *ex* Sheffield; but since October last through Scottish passengers have been able to make a considerably quicker journey by utilising the through coaches which are detached from the same train at Sleaford, and run thence to Grantham, where connection is made with the 10 a.m. "Scotsman" from King's Cross. The latter coaches are worked back to Peterborough during the afternoon, and form the through portion of the south-bound Liverpool-Harwich boat express, leaving Peterborough North (G.N.) at 6.27 p.m., and joining the boat express at March.

[Reply to "THROUGH SERVICE."]

L.M.S. Services, Birmingham-Walsall.

Trains travelling between Birmingham and Walsall or Wolverhampton *via* Bescot travel variously by the Aston route, into and out of the London end of New Street station, or by the short spur *via* Soho Road and Handsworth Wood, which gives access to and from the country end of New Street; the two up trains mentioned by you follow the latter route, but the actual routing is governed in each case by convenience as regards platform accommodation, &c., at New Street at any particular time. The Bournemouth expresses, non-stop between Crewe and Birmingham, are routed *via* Aston, and then take the straight line from Portobello Junction (Willenhall) to Bushbury Junction, avoiding Wolverhampton.

[Reply to H. A. WHITE.]

Drawbar Pull.

Tractive effort, as we have previously explained, is a very approximate, and in some respects unsatisfactory, measure of locomotive tractive capacity. There are many ways in which it is possible for an engine to show a momentary drawbar pull in excess of its nominal tractive effort, both from internal and external causes, and the figure of 16½ tons starting pull in the case of a test run with a North Western 4-6-0 "Prince," though probably only for a second of time, is perfectly correct. In stopping, the question of braking is directly connected with the drawbar pull recorded, especially when a driver puts on steam again to draw farther up a platform before the train brakes have been fully released.

[Reply to W. S. UPTON.]

Working Pressure.

High working pressures have been a feature of Great Western locomotive design for a number of years past, and though this practice has a certain influence on the high speeds developed on that railway, it is only as these pressures are combined with other related features of G.W. design. There is a considerable difference of opinion among locomotive engineers as to the advisability or otherwise of pressures above 200 lb. per sq. in., as, although high

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pressures offer an immediate advantage in increased tractive effort, there is the practical certainty, on the other hand, of increased costs of boiler maintenance, and the tendency since the introduction of superheating has been rather to reduce working pressures than to increase them.

[Reply to E. BEDDOES.]

Plymouth, North Road, G.W.R.

At most important stations where through working is in operation, and especially where there is no running at speed, modifications of ordinary block signalling are permitted in order to facilitate the platform working. This will explain why you have noted trains at this station drawing up to a platform along a line already occupied. Such movements are usually controlled by special "draw-ahead" signals, which are designed to give permission to proceed cautiously while the ordinary home signal above them, remaining at danger, indicates that the block is not clear; but occasionally the ordinary block signals are employed without variation.

[Reply to W. S. UPTON.]

Electric Railways.

Please see reply in the May number to A. Gillies under the heading "London Electric Railways." This will partly answer your questions. As to the extent to which you have seen permanent way and other men actually touching the conductor rails, we doubt the accuracy of your observations, unless you refer only to the negative conductor. In reply to your suggestion that questions should be given as well as replies, this would take up far too much space, and the best we can do is to phrase the replies so that the general character of the enquiries can be appreciated by readers generally.

[Reply to A. G.]

Tank Engines on L.M.S.R. Expresses.

Presumably, a 2-4-2 tank engine brought the up express mentioned to Northampton from Rugby only. The explanation may be either that this was part of the main train only, or that owing to an engine failure or for some local reason, the tank engine had worked the train on this stage. Reference has already been made to the fact that a number of L.M.S.R. passenger locomotives are now being painted black instead of red. We have no official information as to a change of policy, but understand that the matter is under review.

[Reply to "NORTHAMPTONIAN."]

Avonmouth Docks to London *via* S.M.J. Line.

Banana trains such as those mentioned by you, travelling between Avonmouth Docks and London, *via* Gloucester, Cheltenham, Ashchurch, Broom Junction, Byfield, Ravenstone Wood Junction and Olney, have been run as required for many years past, receiving special attention on the part of the S.M.J. Railway. This was one of the few instances where a large railway company took advantage of a short cut provided by a small independent company in preference to a longer route entirely on their own metals.

[Reply to C. R. CLINKER.]

Engines on Fenchurch Street and Blackwall Service.

Engines used on this service are uniform with the smaller 0-6-0 classes of the Great Eastern Section, L. & N.E.R., and are so classed in the records, but some have the leading side-rods removed (converting them into the 2-4-0 type), to lessen wear and tear and reduce internal resistance, as the duties on which they are engaged are comparatively light, and the adhesion with two pairs of wheels only is ample. There are no G.E. locomotive numbers (old numbering) higher than 1900.

[Reply to H. I. J. G.]

Non-superheated Main Line Engines.

There are on most of the chief sections of our large groups certain types of engines engaged on main line service which were built before the days of superheating, and which are not listed for rebuilding with superheaters, although many other comparable types on the same railways may have been partly or wholly so treated. "Experiment" class 4-6-0 engines on the Western Division of the L.M.S. come in this category, and there are doubtless adequate reasons in every such case as to why no rebuilding has been attempted.

[Reply to J. N. B. GILMOUR.]

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Southern Railway Electrification.

The electrification position on this railway is somewhat difficult, in view of the two entirely different systems of electrification which are in use on the Brighton and South Western sections respectively, and in both cases with entire success. We have no information on which to state what the future policy is likely to be in this matter, if such policy has yet been decided on; but in any case you may take it as certain that no alteration will take place in the systems at present in use, at least for some years to come.

[Reply to V. SEARLES-WOOD.]

Steam Heated Trains.

Mr. G. R. Humphrey mentions that the coaches referred to are mostly working in suburban set trains made up as follows:—3 six-wheelers, 4 old main line bogies fitted with steam heating, 3 six-wheelers. The six-wheelers are certainly fitted with a steam connecting pipe, but upon close observation you will note that the pipes pass under the carriage but not into the compartments. This has been done to supply heat to the bogie coaches in the centre of the set and not to the six-wheelers.

[Further reply to C. THOMPSON.]

Tunnel at Golder's Green.

E. G. H. and others point out that, as part of the alterations to the tracks, yard and approach to the car sheds, the shunting neck on the southbound side of the line has been extended southwards in tunnel. The original stops were at the running tunnel's mouth, but, as the depôt road had to be slued to the south, the shunting neck would have been shortened but for the extension in tunnel. The length in tunnel is sufficient to give accommodation for two six-coach trains.

[Further reply to HORACE S. HACK.]

Photographs of Express Trains.

Wherever possible, particulars are given of the locomotive hauling a train shown, and frequently of the location. As, however, we are dependent upon the photographer for such information, it is not always practicable to give this. Consequently, we are unable to supply the further particulars required. As for the photograph of Great Western Birmingham train drawn by a "County" class locomotive, it does not follow that a two-hour express was depicted.

[Reply to "SILURIAN."]

Piloting.

On lines such as the Great Western, where the piloting of express trains is the exception rather than the rule, you may take it that the appearance of a pilot on an important express, without apparent justification, is a certain indication that one of the engines concerned is being worked home to her shed. Beyond the giving of assistance to the train engine, this method results in less congested line occupation than if the pilot were to be worked home "light."

[Reply to KENNETH WINTER.]

L.M.S.R. Locomotives.

As fully explained in the February issue, the renumbering distinguishes between English and Scotch locomotives, while the reservations for engines of individual lines, of which particulars were given, provide all that is practicable without covering the whole list more or less *seriatim*. As many L.N.W. locomotives of the same class had widely distributed numbers, it is impossible that the renumbering should bring them into groups in any degree corresponding with their old numbers.

[Reply to "SHED 16."]

Quadruple Sections, L.M.S.R.

The Midland Railway Appendix for 1911 gives only various short lengths of quadruple lines in addition to those given in the *Railway Year Book*, such as: Sheffield South to Dore and Totley; New Mills South Junction to Chapel-en-le-Frith (except between Chinley North and South); Milford Tunnel and London Road Junction, Derby; Washford Heath Junction and Water Orton; and at several important stations and junctions, Masboro', Beighton, Tapton, Rotherham, Toton, &c.

[Reply to "LLANTHONY ABBEY."]

Bettws-y-Coed Station, L.M.S.R.

The station you name was evidently signalled some years ago. Modern practice would not provide a "distant" for the ground frame and, were this found actually necessary, the ground frame "distant" would be what is called

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" back-slotted " by the starting signal so that it would not go to " clear " unless the starting was " off." The wire into the signal-box would, no doubt, be connected to the ground frame slot on the starting signal.

[Reply to A. COCKING.]

" Special Limit " Timings, L.M.S. (Midland Division).

On the fastest timings over this division special limitations of load are in force, and the schedules in question are known as " special limit " timings. The figures generally are 150,180, 200 and 240 tare tons over the principal sections of the main line for engines of Classes 1, 2, 3 and 4 respectively, but these tonnages are reduced by from 10 to 20 tons over such difficult sections as Derby-Manchester. Hellifield-Carlisle and others.

[Reply to G. E. WALKER.]

Colours of Locomotives.

Great Northern engines in Patrick Stirling's time were painted substantially the same shade of green as that at present used. In the old days London, Chatham and Dover Railway locomotives were painted a shade of fairly dark green. In more recent years they were black, but green was adopted under the Managing Committee until the present style of painting was introduced during and after the war period.

[Reply to L. C. and D. R.]

L.M.S. Annan-Brayton Section.

It is the weakness of the long viaduct over the Solway that has occasioned the closing of this line, and the small traffic carried does not warrant the heavy cost of renewing the viaduct, and especially as the Caledonian section of the L.M.S. has now access to West Cumberland *via* Carlisle, over L.M.S. metals throughout. We believe the Longtown-Gretna branch of the late N.B.R. has also been closed through lack of traffic.

[Reply to " WAVERLEY."]

Indicator Shelters on Locomotives.

You are right in assuming that the enclosure fitted around the front of engines, as shown on the photograph mentioned, is an indicator shelter, erected for the protection of men engaged in taking indicator diagrams and making other tests. Mr. Charles C. Macrae, whose name is borne by one of the late L.B. and S.C. 4-6-4 tanks, was a former Chairman of the London, Brighton and South Coast Railway Company.

[Reply to " GOLDERS GREEN."]

Shunting and Wear and Tear.

Undoubtedly constant shunting with heavy loads, which involves frequent reversals and rapid starts and stops every moment or two, is a very hard variety of locomotive work, and is likely to result in greater wear and tear of the engine so employed than if the same engine were engaged on continuous steaming duties of an average character. We have no information as to the particular engine you mention.

[Reply to " SUPERHEATER."]

" Pacific " Locomotives, L.N.E.R.

You are right in your contention that the ultimate " Pacific " stock, when the 40 engines now on order are complete, will be 57 engines. At present 12 (Nos. 4470-4481 inclusive, new numbering) are at work on the G.N. Section, although the actual renumbering has only just been commenced, and 5 more, numbered 2400-2404 inclusive, on the North Eastern section, making 17 now running, and 40 (of the Gresley design) building.

[Reply to GERALD W. SPINK.]

Southern Railway Locomotives.

We have no definite information as to any intention to do away entirely with names on those Brighton section engines which have retained them until now, but your observations, together with other information, suggest that the practice is to be discontinued. In fact, in the case of tank engines, this is almost necessarily the case, seeing that the present style of lettering and numbering would displace names from their usual positions.

[Reply to C. E. PERKINS.]

Pullman Cars, L.N.E.R.

Pullman cars used for Continental trains from Liverpool Street (all others on that section have now been withdrawn), and the Harrogate Pullman express on the Great Northern section have the usual cream livery. The train you noted painted chocolate was, we understand, a Newmarket special run from King's Cross and appar-

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ently made up of vehicles transferred from the Southern Railway for the occasion.

[Reply to " PULLMAN LIMITED."]

L.M.S. (Glasgow & South Western) Locomotives.

We know of no locomotive which has ever run on this railway equipped with a second funnel in front of the safety-valve ; the only parallel of which we can think is that, in the case of condensing engines, an outlet is usually provided for any steam still uncondensed, at the cab end of the engine, but we are not aware that any engines on the late G. and S.W.R. were so fitted. [Reply to JOHN M. GORRIE.]

Wolverton Station, L.M.S.R.

Mr. W. G. Davison mentions that his father was at Wolverton at the time when the alterations in question were made, and explains the altered location of the line as being due to the fact that the old route passed through the centre of the works, so that workmen had frequently to cross the track, with resulting accidents. The present route was therefore adopted to pass entirely outside the works area.

[Further reply to J. W. O. BULL.]

Main Line Switches.

The longest *effective* length of switch used in this country, from the heel to the point of the switch-tongue, is about 30 ft., but such long switches are only used in the case of junctions designed to be run over at comparatively high speeds on each of the two lines concerned. Your other query is not stated with sufficient clearness for us to identify the posts in question.

[Reply to " CLARAIL."]

Southern Locomotives (S.W. Section).

Working pressure of the 4-4-0 and 4-6-0 types rebuilt by Mr. Urie with superheaters is variously 175 and 180 lb. per square inch. No. 720, 4-2-2-0 type, carries a boiler uniform with those of the large-boilered Drummond 4-4-0's, of the last batch prior to his 463–472 series, and prior, of course, to the rebuilding of the 4-4-0 engines concerned with superheaters. [Reply to J. D. WALDER.]

Gresley Articulated Carriage Stock.

Hitherto the Great Northern section of the L.N.E.R. has been the only British railway to use articulated rolling-stock of the Gresley type, but there are indications that this is likely to become a standard form of construction on the L.N.E.R., as the 29 suburban trains now building for the G.N. and G.E. London suburban services are all to be articulated. The system is also in course of trial in India.

[Reply to P. P. RHODES.]

Tractive Effort.

We have already explained that the tractice force formula is of but limited value, seeing that it takes no account of the capacity of the locomotive to raise steam ; and for this reason alone it would be difficult to lay down by formula any precise relation between the nominal tractive force of a locomotive and the number of vehicles which it is capable of hauling. [Reply to " ERIE."]

L.M.S. Electric Rolling Stock.

The new vehicles turned out from Wolverton are used for the electric services on the late L.N.W. and N.L. sections. So far as the London, Tilbury and Southend section is concerned, the vehicles are used in conjunction with those of the Metropolitan District Railway, and therefore agree with their practice and design. [Reply to A. G. P.]

Railway Advertisement Inaccuracies.

We agree that an advertisement issued by a railway company should include pictorial accuracy as to technical details. As, however, the advertisement to which you direct attention is of a purely general character, a severely critical attitude is hardly justified. The particular advertisement is questionable in other respects beside the one mentioned by you.

[Reply to C. F. KLAPPER.]

Southern (S.E. & C.) Railway Locomotives.

The original 2-6-0 tender and 2-6-4 tank engines, Nos. 810 and 790 respectively, were illustrated and described in the RAILWAY MAGAZINE dated November, 1917. Further engines of the 2-6-0 class have been illustrated more recently. In fact, No. 822, the three-cylinder 2-6-0, was illustrated as frontispiece to the April, 1923, number.

[Reply to H. R. URIDGE.]

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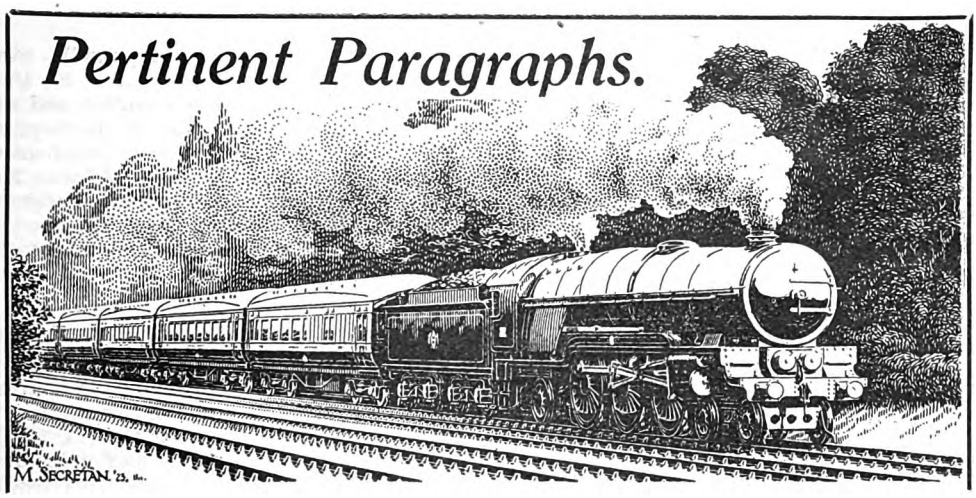
Pertinent Paragraphs.



Irish Railways Amalgamation Bill.

THE Irish Free State Government Bill for the re-organisation of the railways lying wholly in Southern Ireland proposes the amalgamation into one company of all the railways lying solely within the Free State, except certain small lines. The companies concerned are described as " amalgamating " and " absorbed " companies. The " amalgamating " companies are the Great Southern & Western, Midland Great Western, Dublin & South Eastern, and Cork, Bandon & South Coast. Amongst the 21 " absorbed " companies are the Cavan & Leitrim, Cork Blackrock & Passage, and Dublin & Kingstown. When the amalgamated company is constituted, it is to be governed by a Board of not less than 12 nor more than 15 directors. Failing the submission by the four amalgamating companies before July 31, 1924, of agreed schemes of amalgamation and absorption, the railway tribunal to be constituted under the Act will itself prepare schemes. The tribunal is to consist of three members, viz., a practising barrister, or a present or past holder of judicial office, as Chairman, a competent accountant, and a person with intimate knowledge of railway affairs. It is to hold office for five years, and also to have jurisdiction as to rates and charges.

Additional and temporary members of the Tribunal may be appointed, and for this purpose there will be constituted a " general panel " and a " railway and canal panel." It is provided that, so far as the amalgamated company is concerned, the charges in force on April 3, 1924, may remain in force as maximum charges, but within three months of the passing of the Bill they are to be reviewed. Classification of merchandise is to be determined by the Tribunal, and the amalgamated company is to submit schedules of its proposed standard charges. A special clause is inserted in the Bill for the protection of ports, which is intended to preserve, so far as possible, existing safeguards. In the case of non-amalgamated companies charges are to be the same as were in operation at the passing of the Act, subject to the power of the Tribunal to reduce or increase them on application by traders or railway companies. The Tribunal is to take over every function, jurisdiction, and power exercised by the Railway and Canal Commission.

The Bill provides for compensation to be paid to existing officers or servants who cease to hold office by reason of the amalgamation. Exceptionally favourable terms are being extended to the baronies guaranteeing certain narrow-gauge lines. It is proposed that the whole scheme shall come into actual operation on June 1, 1925, or at such later date as may be found necessary.

In general, the provisions are very similar to those of the British Railways Bill of 1921. The proposals are not, however, being accepted unanimously, judging from the attitude of certain of the railways affected.

Recollections of Crewe.

MR. W. WHITE sends some further comments in regard to Mr. Sams' article under this title, as follows :—" I was living near Willesden in 1895-1899, and had ample time to study those interesting engines, the Webb three and four-cylinder compounds. The tank compounds were running later than mentioned by Mr. Sams, I think, because as late as 1899 I used to see the 4 ft. 6 in. one, No. 687, running on the Willesden-Herne Hill (through coach from Liverpool) train, passing through Uxbridge Road at 5.15 p.m. There were four compound tanks built between 1884 and 1887, Nos. 2063, 687, 600 and 777. New numbers were 3026,

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1967, 1963 and 1977. No. 3026 used to run from Willesden to Croydon regularly from 1890 to 1893, as I used to see her passing Clapham Junction when I was a boy, but the goods tank, which had coupled and uncoupled wheels, I saw only twice at Willesden. Of *Jeanie Deans*, I must say I have (or did have) the greatest admiration for her. You could always see her at Willesden at 2.12 p.m. every afternoon on the 2 p.m. down 'Corridor.' She was always piloted to Willesden from Euston with a tank or 0-6-0 goods, but I never saw her take a pilot from Willesden, even with one coach over the limit 20½ load, and (with only a single exception) I have never seen her assisted to start like her sisters, *Pacific*, *Celtic* and *Gaelic*. These three were the worst starters of the ten 7 ft. compounds. When *Jeanie Deans* was in the shops *Adriatic* generally took the 'Corridor,' but she mostly had a 7 ft. 6 in. single all the way to Crewe. Also when a *Greater Britain* took the 2 p.m. down, if it had 20½ coach load, it had a 7 ft. 6 in. single to assist it. People were generally up against Mr. F. W. Webb, but where in England in 1898 was there an engine that could clear Willesden in 10 minutes (5½ miles) with a train like the famous 5.30 p.m. down, 330 to 350 tons, and climb up Euston bank (1 in 70) like Webb's four-cylinder compounds, *Jubilee*, *Canopus*, *Iron Duke*, &c.? I remember taking a friend of mine to Willesden to try to convince him that the L. and N.W.R. hauled the biggest loads, and we got to Willesden just as *Jubilee* tore through on the 5.30 p.m. down with 12 coaches at 5.40 p.m. It settled all his doubts, and it was weeks before he had done talking about *Jubilee* and the 5.30. I see the 'Gresley' 4-6-2's here at Newark every day, but I never forget my old friends, the 'Webb' compounds."

Mr. Sams' Comments.

MR. WHITE's letter has been considered by Mr. Sams, who comments thereon as follows:—"I cannot recollect the exact demise of the various compound tanks, but No. 2063 had disappeared before I went to Crewe; the later three all went close together, somewhere about the time that I mentioned. The one Mr. White used to see, No. 1967 (late 687), went straight off the suburban services into the 'Bone yard.' I think that No. 3026 (late 2063) was not built as a compound, but converted from a 5 ft. 9 in. 'Metropolitan' 4-4-0 tank (originally built by Messrs. Beyer, Peacock & Co.). No. 1963 (late 600) was the 3,000th engine built at Crewe; hence the number (which was temporary) shown on the illustration in my contribution. When I assisted in the repairs of No. 1304, *Jeanie Deans*, No. 2053, *George Findlay* (2-2-2-2 compound), took her place, but both the drivers told me that she was inferior to their own engine, and she always had a pilot on the up journey, to my knowledge. As to the Stephenson centenary engine, I have been told that No. 619, *Mabel*, was sent, but I have an engraving somewhere showing a procession of engines past George Stephenson's cottage, which includes *Locomotion*; hence my remark."

An Unusual British Railway Venture in France.

TOWARDS the end of the long period during which competition for the Continental traffic was extremely keen between the L.C. & D. and the S.E. Rlys., the latter had an inspiration which it hoped would benefit materially the Boulogne-Folkestone routes at the expense of the Calais-Dover service. The cross-Channel boats of those days were not of the powerful type now employed, and many travellers would not cross—as some will not now—when the seas were rough. Suitable hotel accommodation connected with the S.E. Rly. was provided at Dover and Folkestone, so that passengers to the Continent by both routes could pass direct from the train to the hotel if they decided to defer their crossing. Accommodation of exactly this character was not available at the French ports. In 1897 it occurred to the directors of the old S.E. Rly. that if they provided a suitable hotel at Boulogne, it would induce travellers from the French side to patronise the Folkestone route, knowing that if upon arrival at Boulogne they decided not to cross by the connecting boat, proper hotel accommodation was to be had contiguous to the harbour. There was also a proposal to issue week-end, &c., tickets from London to Boulogne, with accommodation at the hotel.

The Zeeland Hotel, land and buildings, and six modern villas in the Rue Jules Lecomte were acquired at Boulogne, at a cost of some £75,000; the Zeeland was demolished with the idea of erecting a down-to-date hotel. Meanwhile the working agreement between the S.E. and L.C. & D. Rlys. came into operation on January 1, 1899, competition between the two routes ceased and there was no longer any incentive for the hotel at Boulogne. There, however, appeared in the S.E. Rly.'s annual accounts an item "Hotel at Boulogne," modified after the working agreement to "property at Boulogne," and disappearing as a separate item when the present statutory form of accounts was introduced. Meanwhile, with a view to making the most of the property, the six villas, which were drained, &c., on English principles, and furnished, had been

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let. With the various railway routes between England and France brought under unified control, the Southern Rly. had even less desire than the S.E. & C. Rly. to hold property in Boulogne, and it was decided to dispose of it. The six furnished villas were therefore offered by auction in the middle of April last.

A Southampton Water Light Railway.

THE Southern Railway shareholders at their recent meeting resolved to take over the Totton Hythe and Fawley Light Railway. This brings to mind a 42 years old project of the late Swindon, Marlborough and Andover Railway. Small railway undertakings always having boundless ambition, the S.M. & A.R., in 1882, obtained powers to extend from Totton (reached by running powers over the L. & S.W.R.) down the West side of Southampton Water to Fawley. The next year further powers were acquired authorising an extension of the line to the coast opposite Cowes and the erection of a pier to facilitate direct communication between the S.M. & A.R. and the Isle of Wight. In 1886 these Acts were taken over by the South Hampshire Railway & Pier Company. A good deal of money was spent in various ways, and eventually the scheme was abandoned. So far the district is still without railway facilities, but now, after many years, it really looks as if the district is to be provided with a railway. In December, 1921, a Light Railway Order was obtained for the construction of a line 9 miles long, from Totton to Fawley. As mentioned above, the Southern Railway has now taken over the project.

Signalling at Horsfall Tunnel.

IN regard to a query sent for the "Why and the Wherefore" section by a Bradford reader, we are indebted to the Chief General Superintendent, L.M.S.R., for particulars of the signalling at Horsfall tunnel, which includes some interesting applications of semi-automatic practice.

The section on the up and down lines between Hall Royd Junction and Eastwood has been track circuited from the down starting signal for Hall Royd Junction to a point 78 yards in advance of the down outer home for Eastwood on the down line, and from the up starting signal for Eastwood Signal Box to the up outer home signals for Hall Royd Junction on the up line. The semi-automatic signals are situated as follows: on the down line, 1,008 yards in advance of the down starting for Hall Royd Junction; and on the up line, 918 yards in advance of the up starting signal for Eastwood.

The starting signals for Hall Royd Junction and Eastwood signal boxes respectively, are mechanically worked signals fitted with electrical reversers and are controlled by the track circuits to a point 625 yards in advance of the semi-automatic signals on both lines. The semi-automatic signals are controlled by levers from the signal box in advance and also by a section of track circuit. The distant signals working with the semi-automatic signals are fixed on the starting signals at Eastwood and Hall Royd Junction respectively. The semi-automatic signals are motor worked, the power obtained from primary batteries, the latter being fixed at the base of the post. Electrical indicators are provided in Hall Royd Junction and Eastwood signal boxes showing the condition of the track in both directions. This system of signalling was installed in the year 1907.

Ilkley as a Railway Centre.

IN regard to Mr. Harold Smith's suggestions published under this title and following paragraphs in the May number, concerning a connection between the Harrogate Pullman express from King's Cross and the 2.53 p.m. ex Leeds if altered to leave the G.N. station instead of the N.E., Mr. G. W. Spink, of Newcastle, adds some further comments: "It is interesting to note that a connection is possible from Holbeck itself, since the Harrogate Pullman stops momentarily at Holbeck (G.N.) before entering Leeds (Central) station. As, however, the stop is a very brief one, and is made only in accordance with Board of Trade regulations, luggage-van difficulties would, no doubt, introduce complications, though a passenger carrying only light luggage could detrain at Holbeck High Level (G.N.) at 2.37 p.m. and descend the stairway to the N.E. platform, in time for the 2·57 Ilkley train. It would, of course, be by no means impossible for a passenger to leave the Pullman in Leeds (Central) at 2.40 p.m. and proceed to the new station in time for the 2.53, though perhaps the excellent luncheon provided by the Pullman authorities would seriously hinder any such attempts to rush! Finally, your correspondent does not mention that L.M.S. and L.N.E. return tickets to Ilkley from Leeds are available for the return half on the line of either company, thus increasing the excellence of the service. Perhaps this is partly due to the fact that all Leeds and Ilkley trains traverse the Otley and Ilkley Joint Railway,* the partners "of which are (or were) the late N.E. and Midland Railways."

* N.E. trains entirely so, and Midland trains partly so, avoiding, of course, Otley.

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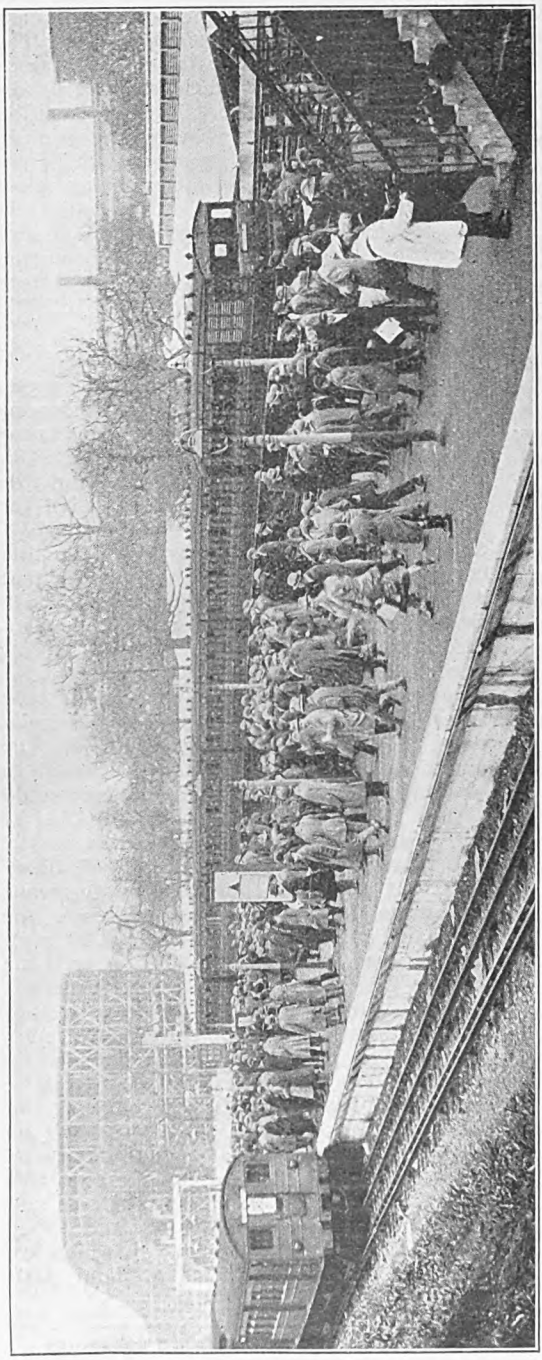
The "Jenny Lind" Mystery.

MYTHS and legends have grown up around the evolution of the steam locomotive which refuse to be laid despite authentic evidence of their lack of reliability. Some 28 years ago long and furious discussions were carried on in the railway and engineering journals relative to the celebrated *Jenny Lind* locomotive. One would have thought that these articles and correspondence settled the *Jenny Lind* controversy once and for all, but apparently this is not so. A correspondent writing from the Surrey Sutton asks: "Which railway owned the original *Jenny Lind*? 'Railways of the World,' by E. Protheroe, states that the York and North Midland Railway owned it, but 'Locomotives of the L.B. & S.C. Railway, 1836-1903,' claim it for the Brighton line."



SCENE AT WEMBLEY PARK STATION, METROPOLITAN RAILWAY (NEW PLATFORM) ON CUP FINAL DAY, APRIL 26.

The facts appear to be that in the autumn of 1846, the L.B. & S.C. Railway was requiring a batch of ten express passenger engines, and John Gray, the Locomotive Superintendent, sent to the Railway Foundry, Leeds, for designs for the engines. David Joy, who was draughtsman at the Railway Foundry, went down to Brighton and spent three weeks at the Works, trying the various engines and discussing with Gray the new type. He returned to Leeds and prepared several designs, incorporating Gray's ideas and several of his own. Whilst Joy was so engaged, Gray left the L.B. & S.C. Railway, and Joy then incorporated several others of his own ideas in a design which included features which had not appealed to Gray. The result of Joy's scheming was a 2-2-2 locomotive, in which the long boiler type was abandoned. This design was accepted for the new express engines by the L.B. & S.C. Railway. The first of the batch of ten engines was named *Jenny Lind*,* and was No. 60 in the locomotive list of the L.B. & S.C. Railway. She was completed at the Railway Foundry, Leeds, in May, 1847, and ran her trial trips on the York and North Midland Railway. Her principal dimensions were:—Inside cylinders, 15 in. by 20 in.; driving wheels, 6 ft. diameter; heating surface:—tubes, 720 sq. ft.; fire-box, 80 sq. ft.; weight, 24 tons 1 cwt.; steam pressure, 120 lb. per square inch. Although the *Jenny Lind* design contained several improvements, it was apparently her steam pressure of 120 lb. that made her so great a success. Previously, 80 lb. to

* So named in honour of a famous Swedish vocalist who took the musical world by storm at this time.

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90 lb. had been the general limit of steam pressure for locomotives. The adoption of the steam pressure of 120 lb. was at that time a revolution. Many interesting details of this *Jenny Lind* will be found in the RAILWAY MAGAZINE for June, 1908, under the caption "Some Links in the Evolution of the Locomotive."

Further "Brighton" Reminiscences.

WE are indebted to G. H. for some further remarks (originally suggested by Mr. Maskelyne's article on the "D" class tank engines) in regard to past and present practice on the "Brighton" Section of the Southern Railway. Referring to Mr. Wallace's remarks concerning No. 4, *Mickleham*, G. H. mentions that about the year 1890 he saw this engine working the royal train of the period between Victoria and Wimbledon, the occasion being the attendance of the ex-German Emperor at a military review on Wimbledon Common. "That potentate was, of course, accompanied by the late King Edward, then Prince of Wales, and other members of the Royal Family, and I suppose the rather unusual route was selected in view partly of the proximity of Victoria station to Buckingham Palace as compared with Waterloo, and partly because of the carriage road available alongside the Brighton company's part of Wimbledon station. *Mickleham* was burnished up to the highest possible degree of brightness, but the only decoration was a coat of arms emblazoned on the circular smokebox door. This was much neater and far more effective than flags, ribbons and wreaths of flowers, which always seem to me so inappropriate a form of ornamentation for any kind of machinery. The royal train at this period consisted of Stroudley stock, and was made up as follows: one 4-wheeled brake van; one 6-wheeled first-class coach; one 6-wheeled Royal Saloon; one 6-wheeled first-class coach; and one 4-wheeled brake van. The outside was finished varnished teak colour, and looked very well in conjunction with the yellow engines. This train remained in use until the present royal train was built by Mr. R. J. Billinton in 1899. When used to take the then Prince of Wales to any point on the system, the engine employed was always distinguished by carrying a facsimile of the Prince's crest of three white ostrich feathers and motto *Ich dien* over the driving wheel splashers. The locomotive used was either a 'G' class single, frequently No. 349, *Albany*, or else a 'Gladstone,' often No. 188, *Allen Sarle*. The top of the coal in the tender was whitewashed. The general effect was very pleasing, as everything was absolutely spic and span."

"A considerable proportion of the ordinary coaching stock was still running teak colour in the late '80's, including some block suburban trains of 10 four-wheeled coaches fitted with electric light. Nearly all Stroudley coaching stock was very light in weight, and there is no doubt that the 'D' tanks worked the services, suburban and otherwise, very smartly, pulling up at stations somewhat abruptly with a sharp application of the Westinghouse brake. The time booked between stations was then often less than at present. The L. & N.W.R. trains between Willesden and Croydon, *via* Crystal Palace, were allowed more time than the Brighton company's own trains over the same section of line. The North Western trains were, however, more comfortable, and I remember as a boy what a treat we regarded a journey in a six-wheeled carriage comfortably cushioned."

"D" Tanks and "Gladstones."

"To revert to the 'D' class tanks, while I yield to none in my admiration of all Mr. Stroudley's engines, I think it is a pity to claim too much for them. Even they had their heavy moments, and would break down sometimes. I remember seeing a 'D 1' tank engine at the head of the old 5·35 p.m. train from Victoria to the Crystal Palace, which then ran from Battersea Park to Streatham Hill without stopping, being pushed up the bank from Wandsworth Common to Balham, train and all, by the following 5.40 p.m. express for Brighton, which loaded very respectably for those days and included a Pullman car. The engine of the express was one of the 'D 3' class of 0-4-2 tender engines with 6 ft. 6-in. driving wheels, like the 'Gladstone' class, but with smaller boilers and cylinders, viz., 17½ in. by 26 in. There was only one down line in those days between Victoria and Balham Junction, although there were two up lines from Balham Junction to Grosvenor Road. The Brighton train had therefore to push the local train right on to the Streatham Hill line before it could proceed on its way.

"With reference to the 'Gladstone' class, there is no doubt that these world-famous engines were wonderfully efficient for their size and weight, and in advance of their time, yet they never seemed to have distinguished themselves as 'fliers.' It would be interesting to know whether they were not allowed to exceed 65 m.p.h. or thereabouts, or whether they found it difficult to do so owing to their small ports preventing their getting rid of the exhaust steam sufficiently quickly at high speeds. Authentic records of the highest maximum speeds attained by these engines would be intensely interesting. One knows, of course, that the

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time-tables of their earlier years did not require anything much, if at all, above 60 m.p.h. as a *general* rule, but there must have been exceptional cases either then or since when higher speeds would have been desirable."

"With reference to J. G. S.'s interesting notes on page 334 of the April number, relative to 'Brighton' 0-4-4 tanks working on the South Eastern section, not all the engines mentioned by him have been specially fitted recently with the vacuum brake for this service. The *Locomotive Magazine* for 1899 shows that Nos. 367 to 374, inclusive, also No. 397, were at that time so fitted, while Mr. Tilling's book (May, 1923, edition) shows Nos. 380 and 391 in addition. I remember this type years ago working through excursions from other companies' lines, chiefly school treats, &c., and also special horsebox trains after the numerous race meetings held at places on the 'Brighton' system. The remainder of J. G. S.'s notes seem to have suffered at the hands of the printer or some one. The 'Brighton' 4-4-0 No. 54 is named *Princess Royal* and not *Princess*."

Unusual Train Routes, Southern Railway.

MR. S. C. CROWTHER-SMITH directs attention to some unusual train routes on the Southern Railway. One service which will commence running, on Sundays, from June 1, will leave Andover Junction at 2.15½p.m. and proceed by way of Andover Town, Fullerton Junction, Romsey, and Redbridge to Southampton (West), continuing thence semi-fast to Waterloo, due 6.7 p.m., a journey of 105½ miles as compared with 66½ miles by the direct route. Another unusual train mentioned by him is that from Windsor at 8 a.m. on weekdays, which travels via Wraysbury, Egham, Chertsey and Weybridge to Surbiton, thence non-stop to Waterloo. Obviously, these are composite journeys made by one set of vehicles to serve several sections or to provide through facilities for the benefit of certain intermediate stations which would not be used by passengers from end to end. Frequently there are no corresponding return services to such trains shown in the public time-tables, but in some instances, at least, the vehicles will, no doubt, work back the same or another way, though scheduled as separate trains for the respective stages.

Grassington Branch, L.M.S.R.

COMMENTING upon Mr. Harold Smith's remarks, included in a "Pertinent Paragraph" in the May number under the above title, Mr. K. J. Holmes, of Sheffield, mentions that parallel to the L.N.E.R. London–Manchester line at Sheffield is a goods yard belonging to the former London and North Western Railway. The goods yard is connected with the L.N.E.R. a few hundred yards to the east of Sheffield (Victoria) station. He has seen several times the two engines, Nos. 10452 and 10412, referred to by Mr. Lupton, in Sheffield station or within a hundred yards of it; also No. 10413. Another point Mr. Holmes mentions is that since the amalgamation he has twice seen a G.N.R. engine on the 1.15 Retford-Sheffield slow, which arrives in Sheffield at 2.10 p.m. The two engines were Nos. 1344 and 1324 respectively, both 4-4-0 type.

"Trans-Canada Limited" Express.

SENDING particulars of the schedule of this well-known train for the 1924 season, Mr. Eric Crickmay, of New York, comments upon the very creditable timings on various sections, particularly between Calgary and Medicine Hat, 5 hr. 5 min. being allowed for the 176 miles through more or less mountainous territory. The train leaves Montreal at 6 p.m., Vancouver being reached at 9 a.m. four days later, a period, allowing for changes of time, of 90 hr. The east-bound train leaves Vancouver at 5 p.m., the arrival at Montreal being at 2 p.m. four days later. Between Toronto and Vancouver the time is 4 hr. 10 min. less from Toronto, and 5 hr. 25 min. less from Vancouver. The trains include through vehicles from Montreal to Ottawa and Vancouver, Toronto to Vancouver, and Fort William to Winnipeg.

Jubilee of a Great London Terminus.

WITH reference to Mr. J. F. Gairns' article on Liverpool Street Station, published in the May number, certain additional or revised particulars, covering information received too late for inclusion, may be briefly outlined. The principal of these is that the Pullman cars have now been withdrawn from all trains on the Great Eastern section of the London & North Eastern Railway, except the Continental expresses. Consequently, reference to Pullman cars requires to be deleted from the text and from the list of principal trains. With regard to the number of passengers using the station daily, it is now pointed out that about 244,000 is a more correct estimate. On the other hand, the author's remark that "in one busy hour 50 arriving (morning) or departing (evening) trains may convey almost if not quite, 40,000 passengers," can be extended to cover a total of 59 trains in at least one hour. The pedestal train indicators mentioned as being erected behind the buffer stops of platforms 1–6 and 12–18, apply to platforms 11–18 on the East side.

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Continental bookings dealt with in the new Enquiry and Continental Office, approached from platform 9 and from the main booking hall, are under the charge of Mr. G. H. Knight.

Southern Railway Duplicate Coaching Sets.

MUCH of the older coaching stock of the three chief railways, now forming the Southern Railway, is not being repainted the standard green. It is re-painted at Ashford in the Wellington brown of the late S.E. and C. Railway, but the style of lettering employed is that of the Southern Railway, the name and numbers being above the windows; the class is also painted on the doors in letters, as now standard for the Southern Railway, instead of numerals, as employed in recent years by the S.E. and C. Railway. These vehicles being on the duplicate list, have a cypher prefix to the number. Thirds are from 01 upwards and firsts from 0701.

The coaches of the S.E. and C. Railway, L.B. and S.C. Railway, and L. and S.W. Railway are now being used together in close-coupled sets irrespective of previous ownership, the Brighton coaches having the vacuum brake substituted for the Westinghouse. These sets include four and six-wheeled vehicles. In at least one duplicate set is a late L. and S.W. first-class carriage with lavatory accommodation, somewhat of a novelty for a close-coupled set. On the S.E. and C. section the end vehicles are usually more modern S.E. and C. third-class brakes. These, although painted and lettered to match the other coaches in the sets, are not numbered in the duplicate list; but on their ends they carry the duplicate set number, of which one as high as 029 has been observed. On the Brighton section some trains are now running in the new green livery, but with class numerals on the doors instead of the standard lettering to distinguish the classes. A late S.E. and C. 10-compartment third-class coach is in service in the old S.E. and C. livery, but with the words "Southern Railway" in the new standard position along the top, and with the word "Third" on each door instead of the numeral "3." The class word and coach number are on this coach larger than the standard type.

A Pushing Collision.

ON February 9, at Eastwood, between Normanton and Todmorden, L.M.S.R., a collision occurred under somewhat peculiar circumstances. As the 9.45 a.m. freight train from Woodstock to Crofton was passing Dover Bridge signal box, Eastwood, it was noticed by the signalman there to have become uncoupled. The rear portion came to a stand in the section with the brake van about 45 yards west, that is, on the facing side, of Dover Bridge down starting signal. Arrangements were eventually made for the 12.35 p.m. Liverpool to Bradford passenger train to propel this rear portion to Hebden Bridge, the next block post in advance. This passenger train failed, however, to stop short of the standing wagons and came into collision with the brake van at the rear, with the result that the brake van and three wagons were derailed and seven altogether were damaged, two of them considerably. There was no case of personal injury, nor was there any damage done to the passenger engine or train. The goods train consisted of 117 wagons, of which 38 were loaded and the remainder empty, and a 10-ton brake van, weighing in all about 810 tons. It was drawn by engine No. 1645, 0-8-0 type, with eight-wheeled tender. The passenger train consisted of six bogie passenger coaches, weighing in all 151 tons. It was drawn by engine No. 1524, 4-6-0 type, with six-wheeled tender, weighing approximately 111¼ tons. The train and engine were fitted throughout with the vacuum brake, the percentage of brake-power on the train being 68½.

Reporting on the accident, Major Hall regards the two chief features in this case which call for remark as, firstly, the use of the passenger train for propelling the rear portion of the divided goods train instead of employing for this duty the light engine which had been used for examining the up line; and, secondly, the apparent ignorance, whatever the reason may have been, on the driver's part of the whereabouts of the standing wagons, which resulted in the collision. With regard to the former point, the evidence is confusing and the exact times are uncertain, but Major Hall regards it as fairly clear that Signalman Ingham had accepted the passenger train from Eastwood with the intention of using this to propel the rear half of the goods train before he had any conversation with the Manchester Control on the subject, and certainly before the light engine arrived. He considers that, although the signalman was not contravening instructions in using his own discretion without prior reference to the control as to the method he adopted in clearing the obstruction, he committed a distinct error of judgment in using the passenger train instead of the light engine for the purpose. Even if he had not been told of the approach of the latter before he accepted the passenger train from Eastwood—and, as a matter of fact, he had received the telephonic intimation from Hebden Bridge of the

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engine's despatch before he did so—he could still have altered his previous decision by holding the passenger train at his home signal and setting the light engine across to the down line over the crossover road between this signal and his box.

Incidental Factors.

WITH regard to the subsequent collision, the opinion is expressed that, from the manner in which the driver handled the passenger train and the position from which he was driving, he was unaware of the position of the standing wagons, and that he did not give full attention to the message given to him by the station foreman. The case is summarised by the Inspector's remark that all the circumstances of the case point to the conclusion that the accident was largely due to a multiplicity of messages only partially attended to or understood, and to a series of assumptions that, somehow or other, the correct information would reach the man primarily concerned—that is, the driver. So far as the action taken by the Manchester Control is concerned, it is pointed out that the practice of propelling the rear half of a goods train by means of a passenger train behind has been by no means an uncommon experience, although the controller at Manchester not only appears in this case to have acquiesced in the arrangement with considerable reluctance, but said that he has never authorised the use of a passenger train for this purpose unless it is absolutely necessary, and certainly not when there is a light engine available. The use of a passenger train for this purpose is open to many and obvious objections, among which, apart from the risk of initial collision, may be included the possible consequences to a passenger train of a derailment of one of the wagons, which is liable to occur when a considerable number of light vehicles of the kind is being propelled. Even if no other light engine is available, it would generally appear possible to detach the engine from a following passenger train in order to clear the line—as was done in this case for the purpose of examining the up road—and the occasions when it is actually necessary to use the whole passenger train for the purpose should be rare. In any case, it should be clearly understood by the men concerned that this should not be done if there is any possible alternative. In this case there was not only a possible but an obvious alternative in the light engine, and the fact that it was not used suggests that the signalman had been so familiarised with the use of a passenger train in circumstances of the kind that he considered the finding of a possible alternative a matter of comparatively little moment.

Holiday Literature, L.N.E.R.

IN preparation for the 1924 holiday season, the London and North Eastern Railway has issued a remarkable series of guide books and other literature. Copies can be obtained at all principal stations on the system and at town offices. Each of the three areas has its own edition of the standard "Apartments and Hotels Guide," substantially in the same form as in previous years, but brought up to date and with certain developments. A new item is a booklet entitled "Holiday Suggestions," with a taking picture in colour on the cover showing a happy group of children enjoying themselves on the sands. This booklet is for general information. Its style is that a page is devoted to each of 70 holiday resorts or tourist centres, headed by a well reproduced scenic photograph with a few notes below. With this book before them, readers should have no difficulty in deciding upon a suitable place at which to spend a holiday. Another interesting volume is one entitled "A Round of Golf on the L.N.E.R.," by Bernard Darwin. This includes articles describing the principal of the many golf courses to which the London and North Eastern Railway gives access, written in interesting style and with a good selection of photographs. Concluding pages give general particulars of all golf courses, these including many which necessarily could not receive individual attention in the main portion of the booklet.

Reference is also necessary to a series of booklets applying to various holiday districts and centres. Each of these has an illustrated cover, utilising to some extent designs which have already become familiar on posters recently issued by the company. The letterpress is descriptive, with a series of photographic views, and there is a folding map showing railway and other facilities in the district in question. The following list indicates the ground covered: London; East Anglia; Buckinghamshire and the Chilterns; The Broads; Lincolnshire; The Yorkshire Coast; York and the Dales and Moors of North East Yorkshire; Nidderdale and Wharfedale; Wensleydale and Swaledale; Tynedale and the Roman Wall; Teesdale and the Eden Valley; Durham County; The Northumberland Coast and Byways; Edinburgh and the Lowlands; The Trossachs and the Clyde; The West Highlands; Aberdeenshire and the Moray Firth; Fifeshire and Forfarshire; Aberdeen and the Dee, Don and Spey. Altogether a splendid selection of holiday literature.

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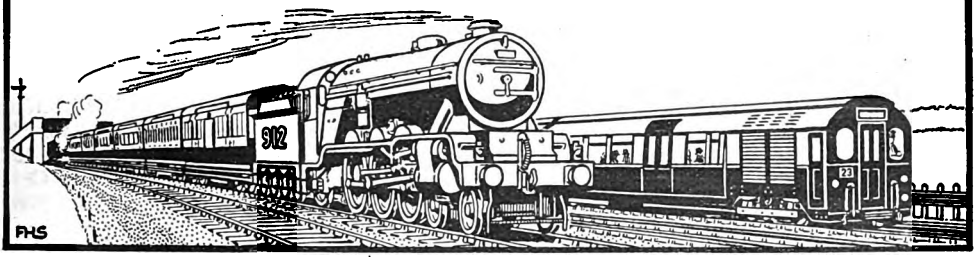
WHAT THE RAILWAYS ARE DOING.



MR. A. F. BOUND, who has been appointed Signal Engineer, Southern Area, London and North Eastern Railway, previously held the position of Signal Engineer for the Great Central Section. Mr. Bound received his early training from 1894 to 1898 as a premium apprentice at the Locomotive Works of the London, Brighton and South Coast Railway, under the late Mr. R. J. Billinton. From 1898 to 1902 he was employed as a draughtsman by the then firm of Vickers, Sons & Maxim. In 1903 he was appointed an outside assistant for the British Pneumatic Railway Signal Company, being engaged on the installation of low-pressure pneumatic signalling in the vicinity of Basingstoke and Staines. In November, 1903, he joined the Great Central Railway as Assistant Signal Superintendent, and in April, 1906, succeeded the late Mr. Thomas Wharmby as Signal Superintendent.

MR. A. F. BOUND,

Signal Engineer,
Southern Area,
London & North Eastern Railway.

* * *

MR. C. CARSLAKE, Assistant Signal Engineer, first of the Great Central Railway and more recently of the Great Central Section of the London and North Eastern Railway, has been appointed Outdoor Assistant to the Signal Engineer, Southern Area, L.N.E.R.

* * *

MR. H. A. EVANS, late Assistant Running Superintendent, York (North Eastern Area), L.N.E.R., commenced his railway career on July 24, 1876, at the Gateshead Works, and served his apprenticeship under Mr. Edward Fletcher, first Locomotive Superintendent of the North Eastern Railway. From 1880 to 1889 Mr. Evans was employed in the Drawing Office. From 1890 to June, 1904, he held positions as locomotive foreman at West Auckland, Bank Top (Darlington), West Hartlepool, and York. In July, 1904, he was appointed Assistant Divisional Locomotive Superintendent for the York district, and from 1914 to 1920 was Acting Divisional Locomotive Superintendent for that division, being given charge of it from 1920 to 1922. During 1923 and until his retirement he held the office of Assistant Running Superintendent for the North Eastern Area.

* * *

MR. P. C. DEWHURST, M.I.Mech.E., for some years Locomotive, Carriage and Wagon Superintendent of the Jamaica Government Railways, was recently appointed Chief Mechanical Engineer to the Government of Colombia in connection with the unification and improvement of both the existing and future railway systems. As head of the Mechanical Department of the Direccion de Ferrocarriles, Mr. Dewhurst has, in addition to the usual sections coming directly under that department, technical functions in respect to bridges, permanent way and traffic operating.

* * *

MR. A. E. TATTERSALL, who has been appointed Assistant Signal Engineer, Southern

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Area, London and North Eastern Railway, was previously Signal Superintendent for the Great Northern section. Born in 1883, Mr. Tattersall commenced his railway career on the Lancashire and Yorkshire Railway, where he was engaged upon the installation of electric pneumatic signalling at Bolton, intermediate automatic signalling between Middleton Junction and Castleton, also track-circuiting at Liverpool in connection with the electrification of the Liverpool-Southport section. These installations were among the earliest in this country. In 1900 Mr. Tattersall went to Ireland as Chief Assistant to the Signal Superintendent of the Great Southern and Western Railway. During his stay there he was connected with the equipment of the Rosslare-Waterford line; also with the installation of the first track circuits employed on the Great Southern and Western Railway. In 1907, when the Metropolitan Railway was considering the adoption of power and automatic signalling, Mr. Tattersall joined that company. While with the Metropolitan Company Mr. Tattersall was also concerned with the installation of automatic signalling on the East London Railway, the first where alternating-current track circuits were employed. In 1915 Mr. Tattersall was given a commission with the Technical Branch of the R.A.O.C., receiving his Captaincy in 1917. He returned to railway service in 1919, and in January, 1921, was appointed Signal Superintendent to the late Great Northern Railway.

Photo.] [*Elliott & Fry.*

MR. A. E. TATTERSALL,

Assistant Signal Engineer,
Southern Area,
London & North Eastern Railway.

* * *

MR. FREDERICK DOWNES, who has been appointed Telegraph Superintendent for the Southern Area, L.N.E.R., previously held a corresponding position on the late Great Northern Railway. He entered Great Northern service in the Telegraph Department in June, 1887; was transferred to the Telegraph Headquarters Staff in May, 1890, as a draughtsman; in 1903 became Technical Inspector, and in 1912 was promoted to be Assistant to the Telegraph Superintendent. On January 1, 1913, he succeeded Mr. T. Ireland as Chief of the Telegraph Department. During his career, Mr. Downes has been associated with a number of important developments in the application of electricity to railway working, particularly under the late Mr. James Radcliffe, and Mr. T. Ireland, as also in connection with railway telegraphy, signalling, general and train lighting, and track-circuiting. The first example of the last-mentioned was installed at King's Cross in 1893. Mr. Downes was awarded the Rosebery Medals in 1903 and 1904 for essays on "Railway Electrifica-

Photo.] [*Elliott & Fry.*

MR. F. DOWNES,

Telegraph Superintendent,
Southern Area,
London & North Eastern Railway.

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tion" and "Railway Signalling" respectively.

* * *

MR. JOHN YOUNG, who has retired from the position of Accountant to the Cheshire Lines Committee, has held that position since 1896, prior to which he was employed in various capacities in the Accountant's Department of the London, Chatham & Dover Railway Company.

* * *

MR. JAMES MOHAN, the newly appointed Accountant to the Cheshire Lines Committee, entered their service in 1880 as a junior clerk in the Goods Audit Department, was later transferred to the Book-keeping and Expenditure Department, becoming successively Assistant Book-keeper and Book-keeper. In 1921 he was appointed Chief Assistant to the Accountant, which position he occupied until his present appointment.

* * *

WE record with regret the recent death of Mr. Olaf Kjelsburg, chief constructing engineer, Swiss Locomotive and Machine Works, Winterthur, Switzerland.

* * *

ON the occasion of the third annual football match between the Southampton Docks and Marine Sports Club *v.* the Club Sportif Honfleurais, the Mayor of Southampton, Alderman W. Mouland, accompanied by Junior Bailiff F. Trim, and Aldermen Bath and Bowyer, together with several officials of the Company, and various users of the Southampton-Honfleur Line, paid a visit to Honfleur. This picturesque old town with its quaint setting between two green wooded hills at the mouth of the Seine was bathed in glorious sunshine. After the official reception offered at the Hotel de Ville, the visitors were entertained to a luncheon by the Maire of Honfleur and the President of the Chamber of Commerce in honour of the Mayor of Southampton and Mr. Thos. C. R. Orme, assistant marine manager of the Southern Railway at Southampton, and amongst those present were Mr. G. R. Newcombe, assistant docks manager; Mr. E. H. Bone, commercial assistant; Mr. A. J. Tuck, staff assistant. The luncheon was followed by the football match on the Côte de Grace, at which the Docks and Marine Sports Club proved victorious by three goals to nil.

* * *

THE memorial, designed by Sir Edward Lutyens, which has been erected at York to the memory of all the North Eastern railwaymen who fell in the war, is to be unveiled at York on Saturday, June 14. The ceremony will be performed by Field-Marshal Earl Plumer, who was G.O.C.-in-Chief, Northern Command, at York when war broke out. The Northern Command covers the whole of the area formerly served by the North Eastern Railway.

* * *

As owners of the house No. 247, Hampstead Road, N.W., the London Midland & Scottish Railway have been approached by the St. Pancras Antiquarian Society for permission to place upon its walls a commemorative tablet recording the fact that it was once a school which Charles Dickens attended. The railway company have acceded to the request.

* * *

THE Cuffley-Stevenage line, L.N.E.R., is to be opened for passenger traffic on June 2. A service of trains will be provided between Hertford and Hitchin via Stevenage, which will be worked by a rail motor, and four trips will be run each way on week-days. In addition to the new station at Hertford, there will be a station at Bayford, and halts at Stapleford and Watton. A service of trains will be continued between Hertford and Hatfield, but the present Hertford North passenger station will be closed and all passenger traffic will be worked from and to the new Hertford North station.

* * *

IN connection with the Institute of Transport Bristol Congress, May 29-31, the President will receive delegates and visitors at the Grand Hotel from 8 to 10 p.m. on Wednesday, May 28. The Right Hon. the Lord Mayor of Bristol (Mr. Alderman A. A. Senington) has invited the Congress to a conversazione at the Art Gallery on the evening of Thursday, May 29. His Worship the Mayor of Bath (Mr. Councillor C. H. Hacker) has kindly consented to receive those delegates who will visit the city on the afternoon of Thursday, May 29. The Local Committee will entertain the Congress at a garden party at the Clifton Zoological Gardens on the evening of Friday, May 30.

* * *

THE headquarters of the Congress and the delegates' *rendezvous* will be at the Grand Hotel. The following papers will be read: May 29—"The Port of Bristol, Past and Present," by Mr. D. Ross-Johnson, C.B.E.; "The Problem of Road Surfaces with regard to Mechanical Transport," by Colonel E. S. Sinnott, C.M.G. May 30—"Freight Train Formations," by Mr. H. R. Griffiths, O.B.E.;

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"The Next Five Years of Aerial Transport," by Colonel W. A. Bristow. The following visits have been arranged: Thursday, May 29, Avonmouth Docks, the works of Stothert & Pitt, Ltd., at Bath, and a general survey of the City of Bath, and the grounds of the Bath Electric Tramways, Ltd. There will also be a reception at the Pump Room, and a visit to the Roman Baths. Friday, May 30, visits to the works of Great Western Railway at Swindon; the Bristol Aeroplane Company, at Filton; and J. S. Fry & Sons, Ltd., at Bristol. Saturday, May 31, Inspection of the Severn Canals to Worcester, and the works of the Imperial Tobacco Co. Ltd., at Bristol.

* * *

THE L.N.E.R. have authorised and placed contracts for £660,000 for 290 coaches (29 trains of 10 coaches each) for use on their London Suburban lines, with the following firms:—Hurst, Nelson & Co., R. Y. Pickering & Co., Cravens Railway Carriage & Wagon Company, Clayton Wagons, Midland Railway Carriage & Wagon Company, the Metropolitan Carriage Wagon & Finance Company. The coaches will be of the new L.N.E.R. design with teak bodies on steel underframes, arranged on the "articulated" principle. Each will consist of two sets of five vehicles carried on six four-wheeled bogies, and will be fitted with steam heating and electric lights. The compartments will all have upholstered seats and backs.

* * *

THE Ministry of Transport has made an Order authorising the construction of a light railway from Longridge to Hellifield, in Lancashire, and the West Riding of Yorkshire. The railway is to run from Longridge, 8 miles north of Preston, to Hellifield, in the West Riding of Yorkshire. The length of the line is roughly 24½ miles, seven of which are in Lancashire and the remainder in the West Riding.

* * *

THE uniform of the staff of the late L. & S.W. Railway included a red tie. This L. & S.W. practice, as a result of the grouping, has been extended to other sections of the Southern Railway. From May 1, the uniform staff of the S.E. & C. section have been supplied with red ties. The underlying idea is said to be that in cases of emergency these ties can be used by the men as a red danger flag during daylight, and, by placing a protected light under the red necktie, by night also.

* * *

THE three new escalators at Bank station, Central London Railway, were brought into service on May 7. This station was opened in 1900, and with a steady increase of traffic year by year has outgrown its capacity. A new station with a booking hall larger by 4,000 sq. ft. has, therefore, been constructed, and from it three escalators descend to the level of the platforms. The escalators are constructed abreast of one another in one shaft 25 ft. in diameter, the first time such an arrangement has been carried out in this country. The centre escalator is reversible.

* * *

THE Northern Counties Committee of the Midland Railway has decided to introduce corridor trains, and has ordered four new trains of the side corridor type and five engines. Each coach will be 57 ft. long by 9 ft. 6 in. wide, and will be tastefully decorated and upholstered. Electric light will be installed on all the new trains. Thirty coaches have been ordered, and are being built at the L.M.S.R. Carriage Works at Derby. They are intended to replace existing stock rather than to supplement it. The North British Locomotive Company, Glasgow, are building the engines, which will be larger and more powerful than those at present employed on the line. They will be fitted with Belpaire fire boxes. The coaches and engines will be painted the same colours as those which are uniformly applied to similar rolling-stock on the L.M.S.R. system in England.

* * *

FOLLOWING the inauguration last year of the Harrogate Pullman car expresses between London (King's Cross) and Leeds, Harrogate, Ripon, Darlington and Newcastle, the London and North Eastern Railway has decided, with the co-operation of the Pullman Car Company Ltd., to introduce a similar train between Sheffield, Nottingham and London on June 2. The general features of the equipment will correspond almost exactly with those of the Harrogate Pullman car trains.

* * *

IN pursuance of the policy of the Underground to provide a quicker train service across London during the shopping hours, commencing on May 1 a further acceleration in the journey time between South Kensington and Mansion House station was made, reducing the time from 14 to 12 minutes. This was made possible by the re-equipment of trains with powerful motors. Further improvements on the running times of the trains are contemplated, and headquarters staff are busily engaged in working at schemes for further developments in quick transit.

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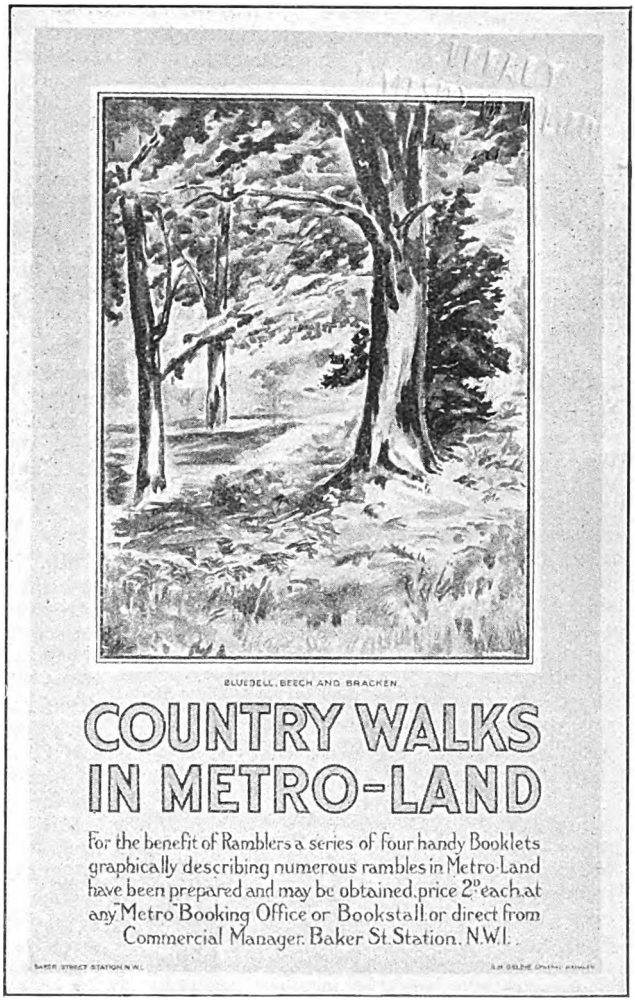
250,000 tickets a day are issued upon the London Underground by automatic machines of various types. An order for 30 additional Rolltic machines, which has just been placed, will increase this figure to 350,000.

* * *

COMMENCING Monday, May 12, the London General Omnibus Company inaugurated their motor coach touring season. Some of the tours operate every day, others on particular days of the week and on Sundays. These are developments of tours which have been operated for some years past with distinct success. They include eleven whole-day tours covering from 70 to 95 miles, the charge of 17s. 6d. or 21s. per passenger including luncheon and tea at first-class hotels where breaks of journey are made. The Hindhead (92 miles), "River" (69 miles, coach and launch), Windsor (70 miles) and Chilterns (95 miles) tours are run regularly. Others are operated as required, principally for guaranteed parties. There are also twelve afternoon tours, leaving about 2 p.m. and returning at approximately 8 p.m., at a general charge of 6s., distances of approximately 60 miles being covered in various directions with an interval for tea. Another feature is a series of 13 half-day tours starting from various suburban centres, the charge being 5s. per passenger. There is also a series of nine evening tours, also from suburban centres. Besides these there are two "Seeing London" tours and two special tours. It is interesting to note that last year 626 of these tours were run, and an increase of 25 per cent. in numbers of passengers carried as compared with the previous year was recorded. All seats can be booked in advance at various booking offices. Full particulars can be obtained on application to the offices at 31, Broadway, Westminster, S.W., adjacent to St. James's Park station, at various Underground stations, at the offices of associated transport undertakings, and of most touring agencies.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IN METRO-LAND
For the benefit of Ramblers a series of four handy Booklets graphically describing numerous rambles in Metro-Land have been prepared and may be obtained price 2p each at any Metro Booking Office or Bookstall or direct from Commercial Manager, Baker St. Station, N.W.1.

A PICTURESQUE POSTER ISSUED BY THE METROPOLITAN RAILWAY.

* * *

MR. A. RANSON COWLISHAW wishes us to record that the station platforms and shelters at Clapham Road, Wandsworth Road and Battersea Park Road, S.E. & C. Section, Southern Railway, have been dismantled. He also refers to the fact that L. & N.W. 4-6-0 locomotive No. 1316 recently brought the East Lancashire express, due in St. Pancras at 5.45 p.m., thus confirming statements as to the use of L. & N.W. locomotives on the Midland section previously made.

* * *

COMMENTING upon remarks by Mr. Glirlson, on page 417 of the May number, Mr. G. Russell mentions that "Brighton" section 2-6-0 engine No. 340 is now running in the new black livery, and that passenger tank engines No. 9 (4-4-2) and Nos. 363 and 476 (0-4-4) have been repainted green.

G

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MR. R. S. JOHN reports that, on April 17, the 12.30 p.m. ex Waterloo was divided, the first portion running to Bournemouth only and the second to Swanage and Weymouth, via Ringwood and Wimborne, Brockenhurst (92 miles) being the first stop. On the same day the first part of the 6.50 p.m. from Waterloo to Portsmouth Harbour ran non-stop to Fratton. He also mentions that the new " 473 " class of mixed-traffic engines are being used on the Portsmouth line ; also that the " 486 " class of mixed traffic 4-6-0's are appearing again in the standard green livery.

* * *

IN addition to instances of London and North Western locomotives on Midland services, Mr. T. G. S. Green, writing from Wakefield, mentions L.N.W.R. " Prince of Wales " class 4–6–0 locomotives working the Heysham boat train, and the Yorkshire express leaving St. Pancras at 1.50 p.m. taken by a Lancashire and Yorkshire 4–4–2 locomotive between Sheffield and Halifax and Bradford ; also the use of Midland 0–6–4 tank engines in the Leeds and Sheffield district, a class which was originally intended mainly for the heavy Birmingham and Manchester suburban services. He also refers to the use of Lancashire and Yorkshire 0–6–0 locomotives on former Midland duties.

* * *

SENDING some further notes as to grouping changes on the Southern Railway, Mr. S. C. Crowther-Smith mentions that the rolling-stock of the Waterloo and City line is now being painted green and lettered " Southern Railway." He also points out that in the case of some of the South Western section locomotives, the power classification numbers are now shown on the splashers instead of upon the frames.

* * *

MR. G. M. HAYWARD reports that North Staffordshire locomotives now work frequently into New Street, Birmingham. He also mentions that, on Easter Monday and Tuesday, race specials were worked through from Peterborough to Birmingham by Great Eastern " T 19 " class locomotives. S.M.J. 0–6–0 engines have recently been repaired at Saltley, Birmingham, Midland 2–4–0 locomotives taking their place temporarily.

* * *

MR. H. T. HOBBS, of Penarth, sends a few notes concerning changes on the Taff Vale section of the Great Western Railway. Most of the stock has been repainted and several locomotives have been fitted with G.W. whistles and safety valves. Several of the class " A " locomotives have had their coal bunkers extended and now conform in shape to the Swindon standard. No G.W.R. locomotives are employed, with the exception of a few 0-6-0 Panier tanks, worked from Cathays and Merthyr sheds. The general service is unaltered, but a few Barry Railway trains work between Cardiff and Barry via Taff Vale metals from Cogan Junction to Biglis Junction. Some of the coaching stock have been fitted with communication cords.

* * *

MR. GORDON C. HECTOR mentions that locomotive No. 453, referred to in the May number, should have been given as No. 452. A number of C2 0-6-0 goods class engines have been rebuilt to the improved C2X class, among them being Nos. 438, 451, 523, 529, 537 and 540.

* * *

MR. C. G. WOODNUTT sends the following notes as to changes on the Isle of Wight railways : The I.W. Railway engine *Ventnor* was painted the standard green of the Southern Railway, and bore the number 15W, which shows that locomotives of all three railways are being numbered in one lot. Other engines in the new livery were I.W.C. No. 8 (8W) and F.Y.N. No. 2 (2W). A number of island carriages are to be seen in the new colours, and wagons lettered " S.R." Changes in locomotive working include the regular running of I.W.C. No. 6 (outside cylinder 4-4-0) on I.W. Railway trains, and I.W. Railway engine *Brading* in its old red livery on I.W.C. trains. Extensive alterations have also been made at Ryde Pier Head station.

* * *

INITIAL letters used between the word " Southern " and the number on repainted engines have the following intimation :— E—Eastleigh Works ; B—Brighton Works ; A—Ashford Works ; similar indications are used for rolling-stock. Mr. G. H. Cannon reports that duplicate South Western section locomotives are now indicated by the addition of the letter A to the number ; also that S.E. & C. section 2-6-0 locomotive No. 825 has been used for tests as to the extent to which engines of the class can be used on the South Western section.

* * *

To speed up the shipping of coal at their Grangemouth docks, the London Midland & Scottish Railway has installed a 35-ton movable electric crane of the latest improved pattern, with which 250 tons of coal an hour can be loaded into ships' holds.

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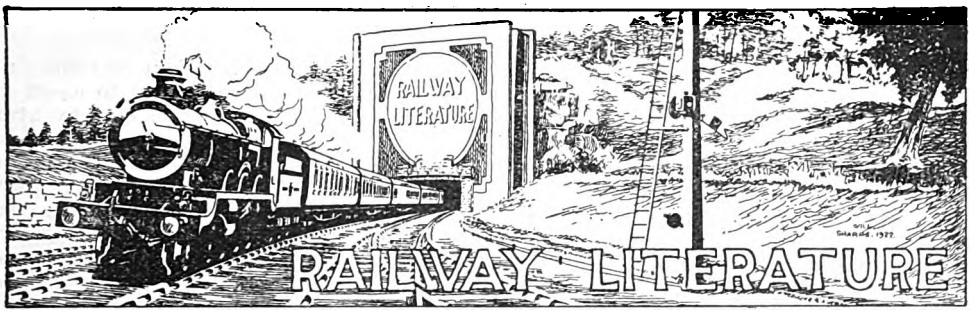

THE RAILWAY YEAR BOOK, 1924. [Railway Publishing Co. Ltd., 33, Tothill Street, Westminster, London, S.W. 1. Price 5s. net; by post, 5s. 6d.]

Published a week or two later than usual, but benefiting in that changes in regard to railway officials and organisation practically up to date are covered, this volume, the twenty-seventh annual issue, constitutes a complete *vade mecum* for railway officers, railway shareholders, contractors, engineers and manufacturers of railway materials and supplies, as well as for the many thousands of readers of the RAILWAY MAGAZINE and others who are interested in railway matters or require information in regard thereto. Special emphasis may be laid upon the fact that the facts and figures are furnished relating to the first year of British railways grouped and re-organised as the result of the Railways Act, 1921, which measure became operative on January 1, 1923. Last year drastic changes in the form and arrangement followed the railway amalgamations, and although at a first glance this new edition may not present such a striking remarshalling of standard features and the incorporation of so many new ones, it will be found, on closer examination, to embody far-reaching extensions of many of the book's established characteristics and much that is entirely novel.

Particular attention will focus on the statistics of the London Midland and Scottish, London and North Eastern, Great Western, and Southern Railways, as this is the first occasion on which the results of a year's working of these four great ownerships have been presented. New maps of the four great grouped lines are provided, drawn on a larger scale than those in the 1923 book, and it is anticipated that they will form a feature much appreciated by a very large number of subscribers. New maps of the Metropolitan and the London "Underground" Railways are included also.

Now that Great Britain has led the way, railway grouping in other parts of the world is a subject much to the fore, particularly in India and in Ireland. In connection with the great Asiatic dependency of Great Britain, two maps are given, one of which illustrates the extent and character of the Indian railway grouping proposals. As to Ireland, the present book describes the railways as they exist to-day, and in view of the inevitable coming changes, this enhances its value to the student of Irish railway history, while at the same time it provides Hibernian legislators with easily available *data* upon which the proposals for Irish railway grouping may be debated and determined. The main features of the Bill as placed before the Dail are outlined.

Political changes in the United Kingdom during recent years have necessitated alterations in the methods of providing railway statistics for the British Isles, and it has been found desirable to place in separate sections much that was formerly furnished as a whole, the divisions being Great Britain, Northern Ireland, and the Irish Free State respectively. Preliminary returns for 1923 in regard to British railways are given on page 98.

A scrutiny of the "Contents"—more extensive than in any previous year—will demonstrate and emphasise the effort that has been made to enlarge the scope and increase the value of the book for reference purposes. Reorganisation of British railway service following the amalgamations has necessitated a complete overhaul of the section known as "The Railway Who's Who." Mention may also be made of the fact that the volume is effectively and handsomely bound in red cloth, well printed, and the statistical and other information clearly presented.

LONDON GUIDE, No. 3. [Published for the "Underground" Railways by Odhams Press Ltd., Long Acre, London, W.C.2. Price 1s. net.]

Prompted by the success of the two guides issued last year, viz., "London's Country, No. 1, North of the Thames," and "London's Country, No. 2, South of the Thames," the "Underground" have been encouraged to publish No. 3, "A Guide to London." Many of the chapters in the new guide have been specially contributed by well-known

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authorities. Those dealing with the Art Galleries have been written by Mr. Collins Baker, the Keeper of the National Gallery. Mr. Randall Davies, the eminent archæologist, has dealt with the museums and historical buildings, and the chapter dealing with hotels and shops has been contributed by the London Association, &c., &c. An endeavour has also been made for the first time to include in the guide a comprehensive map of the principal streets of London, showing also the Tube railway, motor-bus and tram routes comprised within the "Underground" group. Other features of the book are the twelve days' sightseeing itineraries, the specially drawn street plans of the sights of London as viewed from the top of a bus, besides many specially prepared maps and plans. It is hoped that these features, together with the aerial photographs of the principal sightseeing centres, will combine to make the book of real value not only to the tourist but to the Londoner. The guide contains no advertisements and is being sold at a shilling, which is considerably under cost of production. The edition has been limited to 25,000 copies. The guide can be had from any "Underground" station or from the publishers.

MODEL RAILWAYS. By Henry Greenly. [Published by Cassell & Co. Ltd., La Belle Sauvage, London, E.C.4. Price 6s. net.]

The author of this volume needs no introduction to readers of the RAILWAY MAGAZINE, as he is well known for the work he has done in connection with model locomotives and railways, and as author of several previous books dealing with related subject matter. The present volume is well produced, substantially bound and freely illustrated with half-tone views and drawings and diagrams. Chapter I deals with types of model railways; Chapter II discusses the planning of an indoor model railway; and Chapter III the layout of an outdoor model railway. Remaining chapters deal with rail and wheel considerations; points and crossings; permanent way; laying the track; signalling and signals; bridges; station buildings; locomotive sheds, signal boxes, &c., and rolling-stock.

"METROLAND" BRITISH EMPIRE EXHIBITION NUMBER. [Published by the Metropolitan Railway Company, price 3d.]

While, in general, a new edition of a publication which has now been issued, with annual revisions, for a number of years past, the 1924 edition contains, in addition, detailed particulars of the British Empire Exhibition, including illustrations and descriptions of the principal sections, and references and maps designed to assist the visitor to London in finding his way about town, as well as to and from Wembley. Besides this special feature, *Metroland* includes all the usual contents, such as colour plates of places of interest in the area covered by the Metropolitan and associated railways, and particulars of the districts served. Any reader who has not yet obtained a copy of this interesting booklet should at once take steps to do so, either by applying direct to the Commercial Manager at Baker Street or at any Metropolitan station. Included is a useful folding map of the railway and surrounding districts.

BRITISH MACHINE TOOLS. [Published by the Machine Tool Trades Association, 70, Victoria Street, London, S.W.1. Price 10s. 6d.]

Although described as a catalogue, this volume is actually a very complete collection of information and particulars relating to machine tools of all kinds and the firms supplying them. A comprehensive index of firms, indicating their particular specialities and giving postal and telegraphic addresses, &c., is followed by a novel type of index, in which, by means of stars at the intersections of horizontal and vertical columns, the names of firms who deal with particular specialities or classes of machines can be at once ascertained. Following pages illustrate in catalogue form, but with useful descriptive letterpress, standard and other machines produced by the respective firms. We are advised that French and Spanish editions of this catalogue are now in course of preparation.

GUIDE BOOK OF THE PRINCIPAL HOTELS AND RESTAURANTS OF GREAT BRITAIN. [Published by the Incorporated Association of Hotels and Restaurants, 11 and 13, Southampton Row, London, W.C.1. Price 6d. net.]

This handy guide, which includes, in addition to general particulars of hotels and restaurants of all kinds, their tariffs, will no doubt be useful to any of our readers who require to travel about to any great extent, or who may be visiting towns and places of holiday interest without knowledge of the accommodation there available. It is pointed out that, despite suggestions which have been made that hotel charges would be increased in the neighbourhood of London during the period of the British Empire Exhibition, no such increases are shown so far as the hotels included in this guide are concerned.

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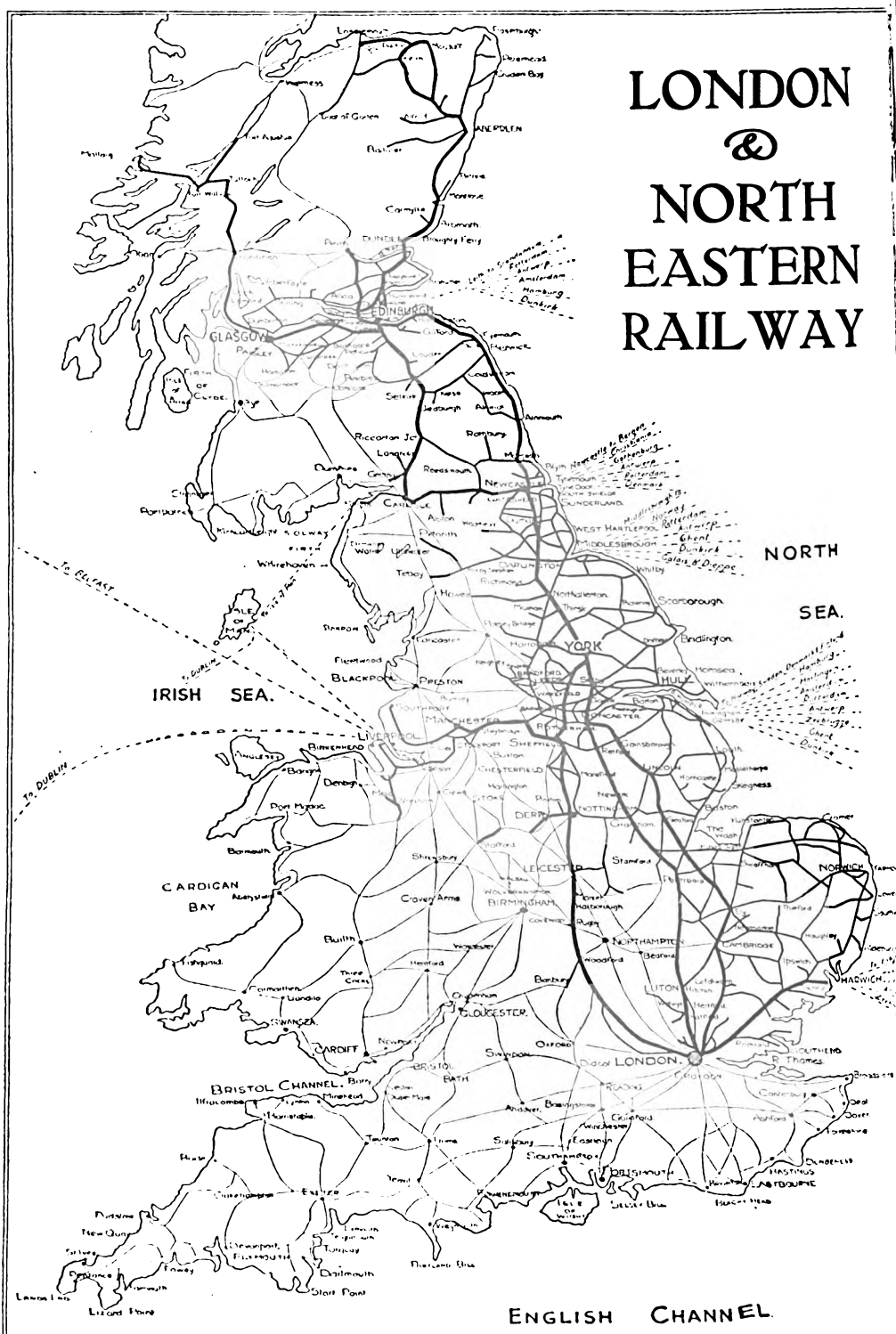

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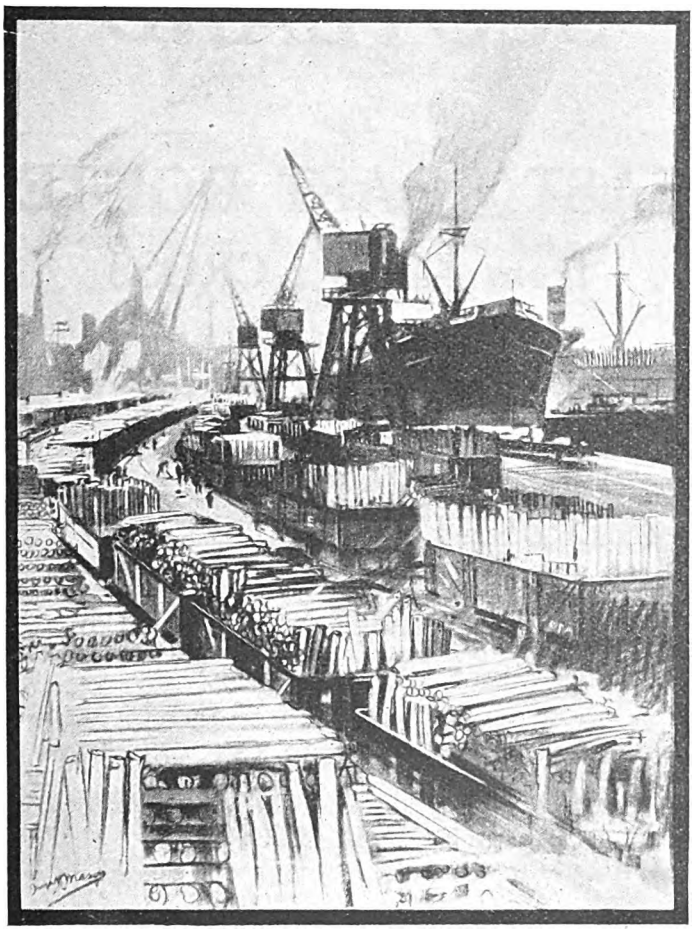

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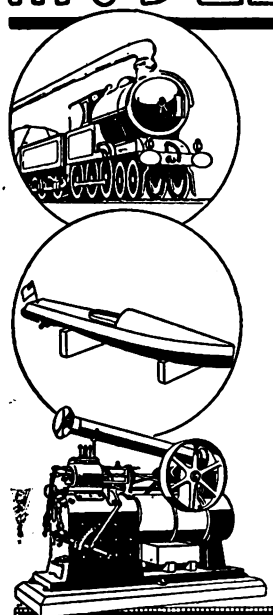

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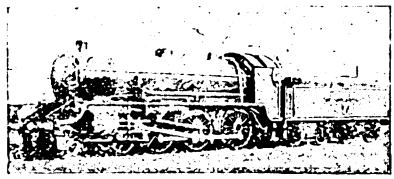

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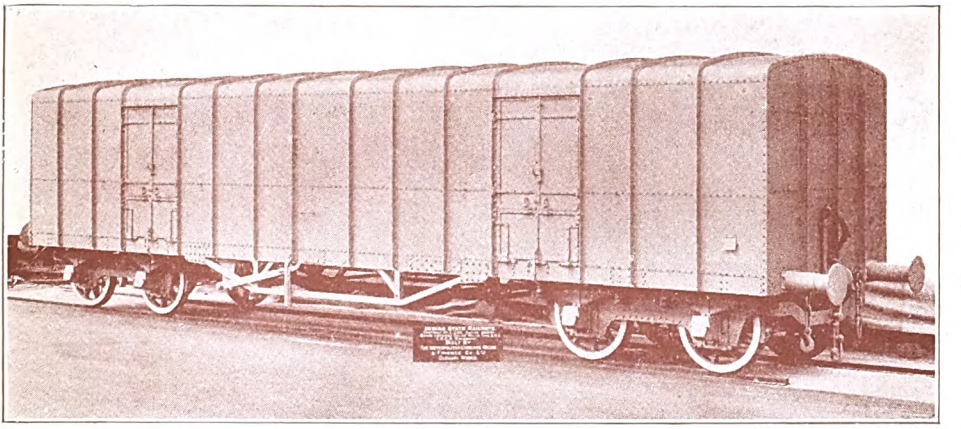

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